Vol. XIX. Part 11.

NATIONAL MUSEUM OF VICTORIA

[Registered at the General Post Office, Melbourne, for transmission by Post as a Newspaper.]

The Journal of the Department of Agriculture of Victoria, Australia.

November, 1921.

PRINCIPAL CONTENTS

The Discovery of Agriculture

True Clovers Naturalized in Victoria

Weeds and Their Eradication

Peach Growing Maize Cultivation

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THE JOURNAL

OF

THE DEPARTMENT OF AGRICULTURE,

VICTORIA, AUSTRALIA.

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W. & W. 797

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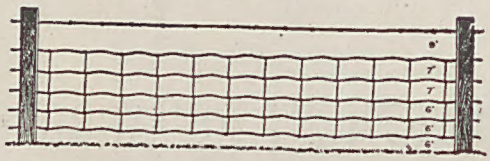

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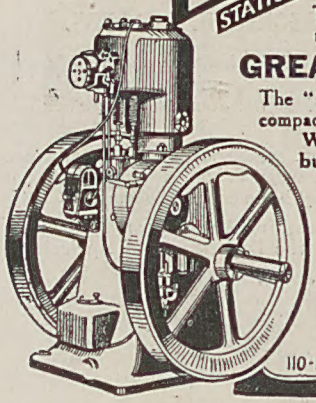

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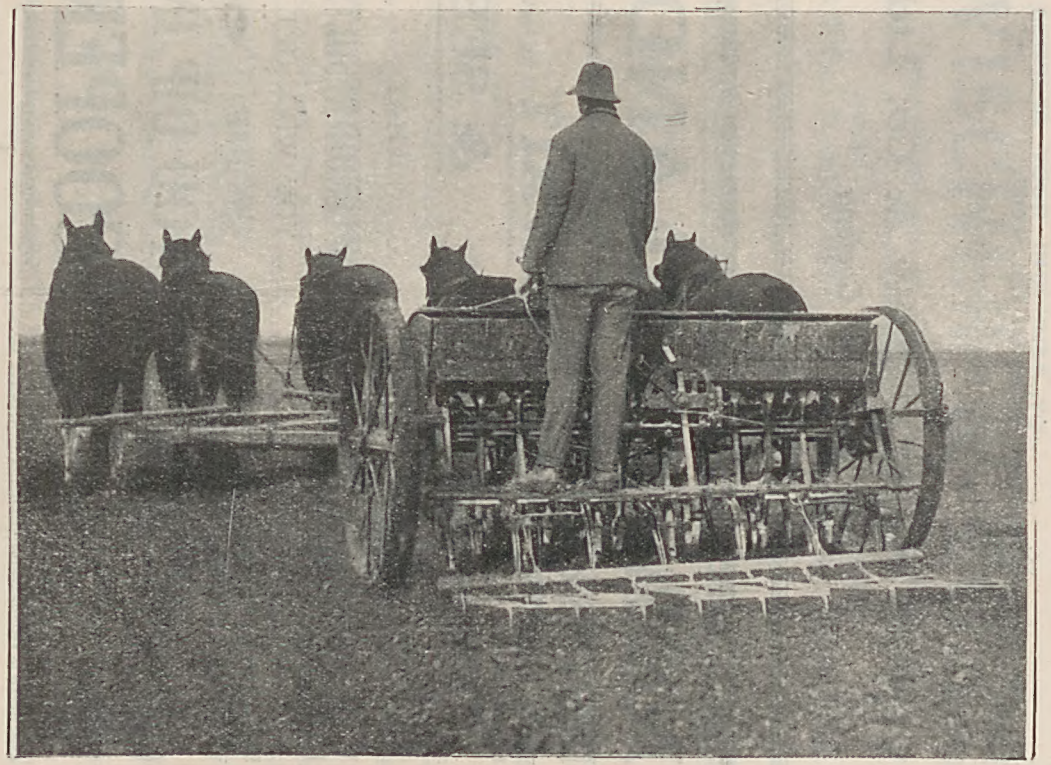

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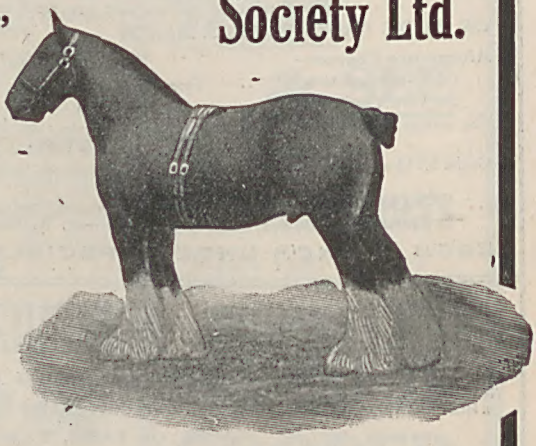

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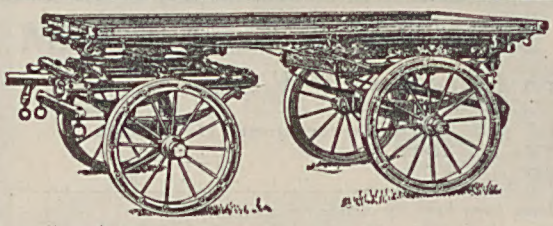

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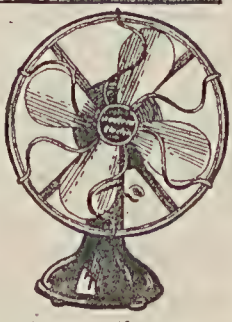

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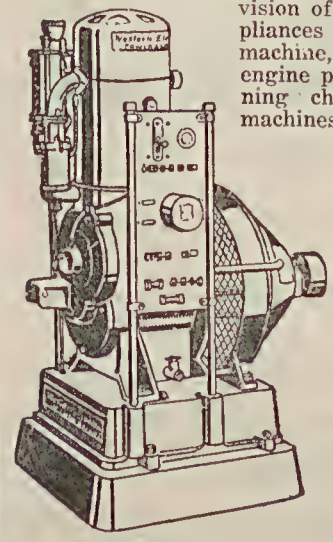

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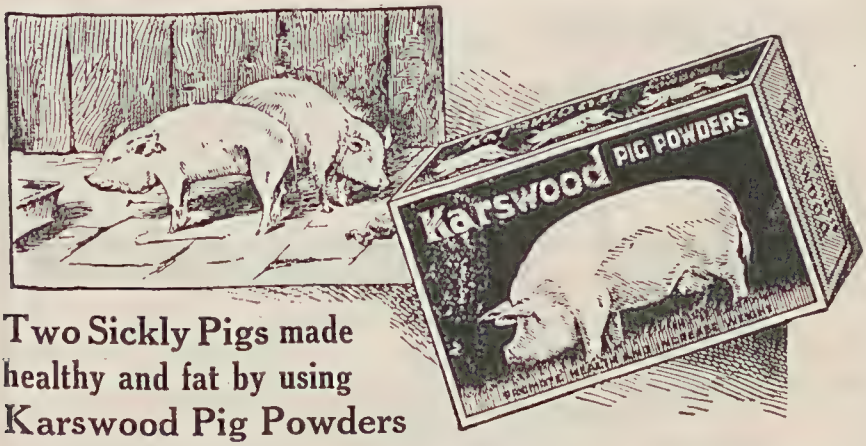

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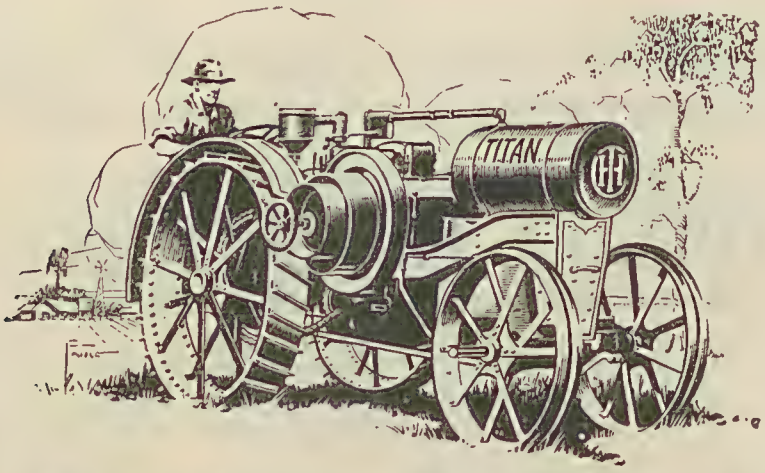

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THE JOURNAL

OF THE

Department of Agriculture

OF

VICTORIA.

Vol. XIX. **November, 1921.** **Part 11.**

THE DISCOVERY OF AGRICULTURE.*

(Continued from page 586.)

By Thomas Cherry, M.D., M.S.

Turning now from theory to the biological facts, it appears that recent work has not only made the old hypotheses untenable, but it has restricted all future speculations by making it very improbable that the wild ancestors of cultivated wheat and barley still exist. We shall show that these cereals present such unique characters that two conclusions are highly probable—(1) The later stages of their evolution took place under abnormal conditions found only in some restricted localities; and (2) that these localities were the Nile Valley, in the case of barley, and a small Ægean island in the case of wheat.

Aaronsohn found a wheat growing on Mount Carmel which had a fairly large grain and an extraordinary beard. The American Government provided him with an experiment station, which was destroyed in the War. Aaronsohn himself was afterwards lost at sea, so that it may be some time before his line of research can be taken up again. Professor Biffin, of Cambridge, has been working with this wheat for several years. He tells me that it carries with it, as a "dominant character," the faculty of making the heads of all its crossbred varieties so brittle that it is useless for breeding purposes. The seeds drop from the heads as soon as they ripen in succession, and the grain remains inclosed in the glumes, which end in a very long beard. These peculiarities insure the survival of the plant, but make it nearly impossible to harvest the crop. The same characteristics destroy the usefulness of the small wild barley (*H. spontaneum*).

The case is still more unfavorable to the claims of the wild wheat of Mesopotamia (*T. monococcum*) as the ancestor of the cultivated

* Paper read at the Australian Association for the Advancement of Science Congress, Melbourne, January, 1921.

varieties. This is a true wheat, which grows as a grass in tussocks. The straw is very slender, and the grains are small. Some 40 years ago, Haeckel proclaimed this as the original of our wheats, and this has become the current opinion on the matter But it is found that *T. monococcum* will not cross with any of the cultivated varieties, so that the question of the descent of the latter from it can be definitely answered in the negative. This species will cross with Aaronsohn's wheat, but the resultant seed is sterile. The search for wild wheat has been steadily kept up for many years past, particularly by the Department of Agriculture, United States of America. The long continued want of success perhaps may be taken to indicate that the wild originals no longer exist.

In order to realize the unique position occupied by barley and wheat, it is necessary to make some broad generalizations. The seed is all-important for the plant, and at the same time it is a source of concentrated food for the animal. Hence the animal is a factor in the evolution of the seed, and it is generally obvious that the seed either escapes from, or else it is spread by, the animal. There is either hostility or alliance. For example, among crop plants, many legumes have unsavoury leaves, and the seeds are so hard that they germinate all the better through being half digested in the intestinal juices of the animal. The seed of the wild oat is small and pointed; it is the earliest of the cereals to ripen in summer, and thus some seeds have already fallen before the surrounding green fodder has been grazed. The pointed seeds bury themselves more easily than wheat or barley. The tough coat protects them from being soaked by light rains, so that "malting" of seed oats is unknown; they, therefore, lie in the soil, perhaps, for years before they germinate, and they pass through birds and mammals without injury. The eradication of wild oats is one of the chief problems of the wheat farmer. Rye is protected by its hard unpalatable straw at the time of ripening, and its seeds have sharp bristles. Its tall head appears to stand up above surrounding plants as an invitation to bird and beast to meddle with it if they can. Rice is protected from the herbivora by growing in water most of the season, the varieties which grow on drier soils are almost certainly artificial strains of the original water rice. Maize hardly comes under this survey, as it was not one of the foodstuffs of the ancient world, but its large flower stalk presents no special difficulty. The other great food plants of the Early World are all surprisingly hardy. The date palm is quite an exceptional tree in flourishing, as the Arabs say, "with its roots in water and its head in hell," and the seed, after being half roasted for the summer in the sand will spring up as the result of the first chance shower. In 1917, dozens of the seedlings made a healthy start around our hospital at Port Said.

The vine appears to have grown wild in Egypt and in all Mediterranean lands, and, according to the Greeks, on the small islands also.* It produces berries to invite birds to eat them, so that the little seeds may be scattered abroad. If by this means each vine secured the growth of a single seedling each year, it would soon become one of the most common plants, for the vine lives hundreds of years, and is only

* Odyssey v. 69.

killed by the attacks of caterpillars, locusts, and goats. When once established, its deep-root system makes it independent of the summer drought, and it loves to grow on limestone hills; but its remarkable root system and power to stand flooding for weeks suit the Nile valley also. The fact that a vineyard, just like a wheatfield, disappears as soon as the wall is broken down is an excellent illustration of the dangers which must be surmounted each year in the regions of a dry summer. The olive is one of the most remarkable trees on the face of the earth. It is reputed to live for a thousand years, and produces, perhaps, 10,000 olives each year, the stones of which are so hard as to defy all attempts at injury. It is one of the easiest trees to grow from seed, slips, or suckers; but it fails to clothe the bare spaces of the earth with food-producing forests. As the tree ages, the trunk becomes wrinkled, and, while most of the bark may be gnawed off, there is always a strip left at the bottom of the wrinkle which long keeps the tree alive. But, in the end, the perseverance of the goat is rewarded. He eats up the seedlings as fast as they appear, and at last completes the ring-barking of the old trees.

When we approach the special problems of barley and wheat, I think we may lay down the following propositions:—They were evolved in regions of dry and nearly rainless summer, and, therefore, not in any forest region (which implies heavy rainfall), or in a snow-clad winter climate. They do not show many of the protective elements seen in plants developed in the ordinary course of the struggle for existence. Cereal wheat, in particular, does not seem capable of maintaining itself as a wild plant. The peculiar conditions which led to the evolution of these cereals could have been found only in some restricted region of the earth, and the possibility of discovering any trace of the wild plants has probably passed away.

Taking first the conditions which are common to the two cereals, we note that the regions of the world where there are winter rains and a very dry summer are singularly restricted in area. They comprise the southern half of Australia, a small patch near the Cape of Good Hope, two narrow strips in Chili and California, and the coastal fringe and islands of the Mediterranean, with an eastern extension through Syria, Mesopotamia, and Persia. In these places the seeds fall at about the longest day, they lie on the ground throughout the summer, and sprout with the first heavy rains in autumn. The plants grow steadily during the winter months, and the crop ripens early in summer, soon after the rain has ceased for the season. A light summer rain does not injure the vitality of the seed on the ground, as it dries again at once. But a heavy rain may cause it to sprout; and, in autumn, if the first rain is only heavy enough to moisten the soil, the seed may remain damp, and malting takes place. That is, there is sufficient moisture to begin the process of germination by changing the starch into sugar, but not enough to complete the process. This is the chief danger of the early sown crop in Australia. It will be noted that Northern Egypt, Syria, and Mesopotamia are all in the region of the winter rains.

Most of the wheat and barley crops of the world are now grown by the aid of the summer rain, and ripen in the autumn. This change probably began about 1500 B.C., when Europe was beginning to be opened up by the great trade routes. Two new dangers were thus

encountered in the shape of frost and of parasitic diseases, such as rust and smut. If these plants had been evolved in the interior of Europe, they would have developed resistance to all these dangers, for other plants have done so in analogous circumstances. An instance of this is seen in the resistance of the American vine to phylloxera, to which all other vines fall victims. Frost is the chief cause of loss to the Russian and Canadian crops, while no variety of wheat is "rust proof," although the susceptiblity to this disease varies greatly.

A discussion on rust leads to very important conclusions, and appears to definitely exclude Europe as the place of origin of the cereals. In Latin, as in English, and other northern languages, the same word is used to denote rust on wheat or barley and rust on iron. The Greeks, on the other hand, called the former rust "red mildew," and used another word for rust on metals, including that on copper, bronze, and iron under the one term. So that the more modern peoples correlated two distinct phenomena by their common colour, as might be expected, if iron and the cereals arrived in Western Europe at about the same time. In the East, wheat was known for at least a thousand years before iron. If this had been the case in Western Europe, it is probable that different words would have been used there also. This inference is confirmed by the religious side of the question. In Italy, where the summer conditions are very favorable to rust, the disease was connected with Sirius, which was then the red dog star. The Robigalia took place on 25th April, when a dog and sheep were sacrificed to avert the rust. The following week, these ceremonies were continued as the Floralia, when red dogs were offered up. No similar ceremonies were known in Greece or the East; whereas, if the cereals had originated in Europe, the proper ritual for their successful growth would have been handed on with the grain.

In early Greece, Apollo and Artemis were the gods of agriculture. They protected the crops, destroyed locusts and mice, and were the averters of rust. Here "locusts and mice" points very definitely to a dry summer climate; one requires to live in such a climate to appreciate the full significance. Smintheus, Apollo's epithet, came from arid Crete. Is it possible that some tradition clung to Delos as having a special connexion with wheat? It was the birthplace of both these deities, and yearly offerings wrapped in sheaves of wheat were sent to the island by a sacred route from Roumania and Illyricum. The archaic mysteries of Samothrace had to do with the Great Mother and were connected with Delos. In Egypt, Sirius was the New Year star and associated with Hathor. In Europe, it was the star of evil omen.

In reviewing the pre-human history of the cereals we must remember that the 6,000 years, during which the crop has been regularly handed on from year to year by the husbandman, are as nothing to the period in tertiary times, during which the plants were exposed to all the yearly changes of rainfall and climate, as well as to the attacks of birds and beasts. And, if we admit that the original home of these plants was in the region of dry summers, somewhere near the Levant, we are faced with the difficulty of accounting for their having survived drought. For all the regions of winter rains lie in the area of high barometric pressure, and the annual rainfall is subject to much variation, so that droughts are phenomena that must be regularly met.

This fact restricts our search to the coast lands rather than to the interior of the continents; for the rainfall becomes more variable and uncertain as the distance from the sea coast increases. These lands were also well stocked with wild deer, goats, sheep, and mice, as well as the larger herbivora. Owing to the quantity of sugar in the blade, there is no grass or other fodder so palatable as young wheat and barley. This fact is another formidable menace to the crop, and an equally formidable difficulty to any theory regarding the evolution of these plants. As the natural self-sown crop springs up rapidly after the first rain at the end of summer—the annual break up of the drought—all wild animals concentrate on the young crop. They are half starved after the long dry period, they have an instinct for green fodder, because most ruminants fall out of health if kept too long without succulent food, and in some species the females have an additional instinct, which leads them near green food in order to prepare for an approaching period of lactation. The young cereals grow more rapidly than any other grass, and hence they have to bear the brunt of the attack. Having tasted the new arrival amongst the natural grasses, all such animals, in Australia at least, cling to the locality throughout the winter. When the ear stalk shoots in spring it is specially palatable, because it is sweeter than the leaves. A little later, the heads are better still, and they are preferred, the stalks and leaves being rejected. At this stage, the birds attack the soft grain in the ear, and any which ripens and falls on the ground is exposed to many dangers throughout the summer. Quail and many other birds, mice, rabbits, and the larger herbivora, and ants, all make their homes in the stubble and search for any fallen heads and single grains. Animals which have never known wheat before take greedily to the new diet. This remark applies to marsupials, cockatoos, and emus.

In Australia we know what is necessary in the way of wire-netted fences and wholesale poisoning to keep the crop free from this list of enemies. We are able to picture the danger which the cereals have surmounted during the hundreds of thousands of years while the struggle for existence presumably reigned supreme. Man has modified the struggle in many ways. In some countries small birds are all of commercial value, in others the rabbits have become rare and the sheep and goats are all kept off the crops. But before man came to the rescue, the live stock of all the surrounding regions would have learnt by experience to pick out the cereals, and in years of drought these attacks would be redoubled. In places like North Syria there is a severe drought at least every 40 years.* In half-a-million years there would be 12,000 periods of drought. It seems very improbable that the wild plants could survive all these periods and yet fail to survive the additional 6,000 years to our own day. Unless one has been through the experience, it is impossible to appreciate the effect of a very dry season in completely re-arranging the balance of nature. Not only is every vestige of grass eaten up, but deep-rooted shrubs and trees disappear also. As the situation in regard to food supply becomes more and more intense, it is very striking to watch the manner in which all animals attempt to live on every green plant however well protected it may be by nature. Herbage is cropped and the bark gnawed from trees and

* There are records of three years drought in Palestine about 850 B.C., and seven dry years killed the trees on some Ægean Islands about 550 B.C.

shrubs which in any ordinary year would never be touched. The cereals germinate with comparatvely light showers, and their root system enables them to carry on for the first six months better than the ordinary grasses. Hence these peculiarities help to ensure their prompt destruction. At the end of the winter of 1902 I remember a very striking case. The rainfall during the previous ten months had been less than 5 inches, yet a chance grain of barley in a wire-netted experimental plot had produced stalks 18 inches long and very good ears. Such growth amidst nearly bare surroundings makes the barley a conspicuous landmark to attract all animals. Green and dry food growing in the most inaccessible places is eaten by mice, birds, and ants. In regions where the plants are regularly exposed to such periods of drought, the shrubs are very deep rooted, the grass tough and wiry, and the trees produce leaves, bark, and roots which defy alike the drought and the animal. But the cultivated cereals exhibit characters which are precisely the opposite of these, so that I do not think that they are the products of a country where droughts regularly occur. Yet it is in the 15 and 20-inch rainfall country that they flourish best, producing heavy yields of grain and remaining quite free from disease. About three-fourths of this rain comes during the seven or eight months between seed time and harvest, the remainder evaporates at once, and is of little use. "Self-sown" wheat and barley last only a few years.

On biological grounds, the large seed of barley was an advantage in the Nile valley or other locality, where the only moisture the crop received was the annual flood in August. The natural sequence in Upper Egypt would thus be—crop above ground by end of September, ripe in December, and the seed lying on the ground for the following eight months. For the plant, the large seeds served a double purpose; they are not so easily soaked and buried by a chance thunderstorm in summer, and thus compelled to germinate in the wrong season, and they provide an unusually good supply of food for the young plant in the period immediately after germination. The large seeds mean a heavier yield per acre, and, therefore, a better chance of survival. In 1914, in a series of field trials with wheat, the best graded seed gave a yield of 28 bushels, as against 24, the yield of the smallest seeds. Barley differs from wheat in being provided with an awn. This sharp point makes it easier for the seed to bury itself, and it is some protection against the smaller birds. The large size and defenceless condition of these seeds seems to be conclusive proof that they are evolved in some area not subject to the full stress of the ordinary struggle for existence amongst plants. If they were ordinary products, we should expect many other similar seeds to be available for human needs; but barley and wheat stand alone, and in some remarkable way their appearance coincides with that of progressive man upon the face of the earth in times so recent as 6,000 years from the present day. It is probable that wild herbivora were not very common in the long narrow valley of the Nile. It is difficult to see what they could find as food from June to November. The incidence of the floods would favour the growth of annual plants and of large trees, but not of perennial bushes. The facts that the seed of barley had increased considerably in size, and that the brittleness of the "rachis" had disappeared, point to special relationship to the animal world and to the annual period of growth. A wild barley, either at Alexandria or in the uplands of Abyssinia,

would presumably have the smaller seed and the brittleness characteristic of existing wild species. Moreover, the proto-Egyptians used barley as food before they had begun the march of civilization, and the associated "rush nuts" indicate that these were not cultivated, and no known examples can be quoted of people practising cultivation who are not also well along the road towards civilization.

We shall now turn to the special problems of wheat and inquire why this grain was probably not cultivated by man until long after barley, and also why it is utterly defenceless in the ordinary struggle for existence, although it contains a higher percentage of nutrients than barley. These peculiarities may be accounted for if we suppose that wheat passed its later stages of evolution in one of the small volcanic or granitic islands of the Archipelago, such as Delos. Such small islands have no indigenous mammals, and some of them were the rookeries of fish-eating birds, owls and hawks, and chattering sea crows.* On such an island the small grain-eating birds may also have been unknown, because the myriads of sea birds scare them away, and the grain would thus be doubly protected. Islands are comparatively free from the droughts which affect the country even a few miles from the shore; and in the Archipelago the monthly incidence of the rain is quite right for the best growth of wheat. It runs somewhat as follows at a station in Crete:—

Under 3 inches per month—November, December, January.
Under 2 inches per month—October, February, March.
Under 1 inch per month—April, May.
Under ½ inch per month—June, July, August, September.

That is, 12 or 14 inches during the winter and early spring are followed by a dry late spring and summer. The crop appears above ground in October or November, and the grain is ripe in June. Such climatic conditions explain also the liability to rust and smut when the grain is grown by the summer rainfall, and thus ripens in autumn. The island theory will also explain why wheat has increased the size and food value of the seed, but evolved no correlative protective mechanism against animal enemies. The fact that its development has run counter to that of nearly all other plants is evidence that it has been evolved under extraordinary conditions. The law is for seeds to become small and numerous, with wings or other contrivances for dispersal, or else to enter into partnership with birds and beasts. But wheat has done neither. On the other hand, if animals of all kinds can be left out of account, the increase in size of the seed is, as we have seen, a great advantage to the future plant.

Another curious fact in regard to wheat, which seems to be due to its having evolved without any relationship to the herbivora, has recently been investigated in America. Wheat differs from oats and maize inasmuch as "animals receiving their nutrients solely from the wheat plant are unable to perform normally and with vigour the physiological processes involved in general vigour of the animal, size and strength of the offspring, and capacity for milk secretion." Animals fed exclusively on maize were more vigorous than those fed on oaten products, but the latter were far ahead of the wheat-fed section in every respect.† A full discussion of the significance of this peculiarity

* Odyssey v. 66.
† Ann. Rep. Wisconsin Expt. Stn., 1911, pp. 131–205.

would detain us too long, but it may be briefly put in this way: The correlated evolution of the plant and of the mammal has resulted in modifications on both sides. The herbivora have been the means of compelling their favorite plants to become vigorous growers in order to make good quickly the injury received by grazing. On the other side, the herbivora seem to have become dependent on these plants for special chemical products essential to their proper nutrition. These products are not ordinary starch and protein, but compounds containing lime and phosphorus in special combinations.

The necessary conditions for the survival of wheat were present in the Archipelago before the advent of man, but not in many other parts of the world. Crete, Cyprus, and the larger islands had small birds and mammals, and the more northern islands come into the zone of summer rains. Some of the small islands off the south coast of Australia would meet all the requirements, but no useful grain has been evolved on them. Flinders, in 1802, thus describes two of them:—"There are four small islands in the eastern branch, one moderately high and woody, the others grassy and lower. Upon two of them we found many young pelicans unable to fly. Flocks of the old birds were sitting on the beaches of the lagoon, and it appeared that the islands were their breeding places. Not only so, but from the number of skeletons and bones there scattered it should seem that they had for ages been selected for the closing scene of their existence."* The luxuriant grass is still on these islands, but the living and dead birds have alike disappeared. The soil was rich enough in nitrates and phosphates to justify the expense of its removal to neighbouring agricultural districts. A similar richness of the soil may have been a factor in the production of the large grain and special protein-content of wheat.

Another point worth recording is the fact that wheat and barley are among the exceptional members of the grasses in being self, instead of wind, fertilized. It is easy to produce new varieties of wheat by cross-fertilization, but this is an abnormal experience to the plant and frequently results in the production of monstrosities in the new head. This shows that self-fertilization has been the plan followed during the evolution of these plants. It is remarkable that the foundations of our civilization rest on exceptions to the general rule of the beneficial effects to the plant of cross-fertilization. I take this to be another indication of the exceptional conditions under which the seeds were evolved. Both these cereals are pliant under new conditions of treatment, and countless varieties have been produced in the course of cultivation; but plants which have fought their way for myriads of years in the struggle for existence exhibit very fixed characters.

Having thus reviewed the salient points in regard to the biology of wheat, we shall see how this hypothesis fits the facts of history. The Egyptians of the earliest dynasties used obsidian and emery, and it is almost certain that they obtained these from the islands of Melos and Naxos, close to Delos. If so, it is possible that wheat was found by men who were acquainted with barley and its value, and were, therefore, likely to appreciate the possibilities of a new food plant. Wheat may thus have reached Egypt, Crete, and Mesopotamia at nearly the same

* Flinders, *Terra Australis*, 1812, vol. I, p. 183.

time (3000 B.C.), because there is evidence of early communication between them, and the Sumerians called wheat by its Egyptian name.*

It will be noted that millet hardly enters into our line of argument, because it was found in only 10 per cent. of the prehistoric bodies, so that it was not so regular a foodstuff as barley. The variety was an African species, at present little cultivated. In contrast with the fixed characters of barley and wheat, the millets are very variable. Endless varieties are known of both seed and plant, and new varieties appear to be easily fixed by artificial means. Like the sorghums, the millets are able to hold their own in the struggle for existence.

There is a further point in connexion with agriculture which must be noted. Cultivation is like the use of fire—the invention is a sudden jump, and not a gradual change. There is no half-way house. A people either tills the soil or it does not, and if it cultivated anything in the Ancient Orient we may be sure that it knew something of millet or barley. The limited amount of time which is available for the spread of this knowledge all round the world is forgotten, and was not known to earlier writers on the subject. Because man of the old stone age lived apparently as a non-progressive being, perhaps for hundreds of thousands of years, it was assumed that civilization took a correspondingly long period to evolve. But, by accepting the modern dates for the beginning of progress in Egypt, and by recognising resemblances as *primâ facie* evidence of the spread of culture by teaching, we are able to make the history of the human race a consistent whole. Thousands of years may no longer be evoked to suit the theory of the historian, for the evolution of civilization in Egypt covered less than the single thousand which fell between 4000 and 3000 B.C.

If this is the true account of the history of wheat and barley, the course of Egyptian history is the natural unfolding of the accidental discovery of two first-rate food plants growing in the Nile valley. Man did not deliberately set to work to solve the problem of becoming a tiller of the soil, but discovered the possibility of cultivation accidentally and without effort. He helped the river to do the business just a little better than it had been doing it before his advent. Of his early plants, wild millet is easily able to hold its own in the valley, but barley had not a very great margin of safety. Wheat can be best accounted for by its evolution on a small island in the Archipelago. Here it was found by men who already knew how to cultivate millet and barley.

Perhaps the most remarkable fact of all this story is that man should have discovered such an array of plants, animals, and metals of first class value at the dawn of civilization in Egypt. Many of these are still the most valuable factors by the use of which man maintains his position, and they have not been superseded by newer products from other parts of the world. In the course of the next thousand years, when Syria, Asia Minor, and Mesopotamia had been added to the domain of the civilized world, and silver, iron, fruit trees, cotton, the camel, and the horse added to man's equipment, it may be said that the list of important raw products was complete. Before the epoch 4000 B.C. man had nothing but the dog; soon after the year 2000 he had gained nearly all that the earth affords.

* Breasted *loc. cit.*, p. 108.

THE TRUE CLOVERS NATURALIZED IN VICTORIA.

By J. W. Audas, F.L.S., F.R.M.S.
(National Herbarium, Melbourne.)

Clover or Trefoil (Trifolium) a genus of plants of the natural order Leguminosæ, and containing about 250 distinct species, is native chiefly of temperate climates. Clovers are found to flourish exceedingly in the temperate regions of the northern hemisphere, to be almost non-existent in the tropical area, and to reappear with luxuriance in the temperate zone of the southern hemisphere. They rank high in agriculture as affording abundant pasture and fodder for cattle. The name of clover is popularly extended to many plants not included in this genus, but which belong to the same natural order, and agree with it in having leaves formed of three leaflets, particularly those which are cultivated for the same purposes as clover, and farmers also frequently apply to them the very incorrect designation of "artificial grasses." The true clovers have herbaceous non-twining stems, roundish heads, or oblong spikes of small flowers, the corolla or inner floral envelope remains in a withered state until the seed ripens, while the pod is enclosed in the calyx (one of the outer floral envelopes) and contains one or two seeds only, rarely will it be found to contain three or four.

Clover may be readily distinguished from Medicago and Trigonella by the pod, and from Melilotus by the compact heads of flower. Most of the species differ from all allied genera by the petals, either all of them, or the three lower ones only, being connected by their claws with the staminal tube.

It is about fifty years since the first introduction of clover into field culture in Victoria, and several species are now frequently grown in succession with grain crops. The agrarian species may be grouped as follows:—Red clover, *Trifolium pratense,* Alsike clover, *Trifolium hybridum,* Crimson or Carnation clover, *Trifolium incarnatum,* White or Dutch clover, *Trifolium repens,* Subterranean clover, *Trifolium subterraneum,* and Perennial Strawberry Clover, *Trifolium fragiferum.* Sixteen species of Trifolium and eleven of Medicago and Melilotus have become naturalized in this State; they are particularized on pages 659 and 660.

There is still much room for expansion in the growth of clover here Many species are obtainable, differing in some respect, but mostly in their length of life. There are perennial, biennial, and annual kinds, and the choice of species for cultivation would depend on climate. Generally speaking, only such of the annuals as can be grown in winter are profitable. In order to assist the agriculturist in making his choice, I have compiled the following brief descriptions of the various species:—

A.—Perennial Species.

Trifolium repens, L. White or Dutch Clover.

White clover is a native of the temperate portion of Europe, Asia, and Africa, and is probably so well known that a detailed description of it is superfluous. Let it therefore suffice

to say that it is one of our exotic forage plants, and of creeping habit. Being shallow rooted, with one deep tap root, it spreads over the ground and multiplies immensely. A single plant will often produce a dense turf 2 feet in diameter. The tap root has sometimes been found to be 30 inches long after about eight weeks growth, but it dies off rapidly as the roots of the spreading runners increase in size. It is this double rooting tendency which causes the plant to maintain itself on soils of entirely different natures. Its growth is so dense that close grazing by cattle does not kill it. Cattle do not seem to relish the flowers, which they avoid, therefore spontaneous seeding is continuous. White clover is not so liable to cause bloating as other clovers. It is a splendid flesh former, and greatly valued for fattening purposes. It is usually cultivated with grasses, and with rye grass will produce pasture very early in the season.

The seed is very similar to alsike, but a little smaller. When garnered from wild plants it persists much longer, even lasting five or six years, and it also withstands the rigors of severe springs better than when gathered from cultivated white clover. Propagation is largely dependent upon insects, fertility falling as low as only 10 per cent. when insects are forbidden access to the flowers. White clover is largely grown in lawn mixtures, and it should be of interest to apiarists to note that it has been long known and valued as a honey-producing plant.

A variety which can be recommended as being twice as large as ordinary white clover is Ladino clover (*Trifolium repens latum*). White clover is present in nearly every kind of soil. Sometimes on poor land it becomes so insignificant as to be scarcely distinguishable among the other herbage, but it is quite ready to burst into luxuriant growth on the first application of manure or top-dressing. When manures are needed for this species, phosphatic fertilizers are the most effective.

Trifolium fragiferum, L. Perennial Strawberry Clover.

The Strawberry clover is a common plant of Europe. It has a perennial root stock, creeping stems, and foliage much resembling that of white clover. The globular flower head is pinkish-white in colour, and not unlike the strawberry fruit in outline. Strawberry clover is well adapted for wet clay soils, and spreads over humid pastures very rapidly, with an even stronger growth than white clover. It stands the summer heat well. All kinds of stock are remarkably fond of it. Two to three pounds of seed may be sown to the acre.

Trifolium hybridum, L. Alsike Clover.

Alsike clover is named after Alsike, in Sweden, where it is extensively cultivated. It is a perennial, exhibiting characteristics which lead many botanists to conclude that it is a cross between red and white clover. It can, however, withstand conditions which would prove fatal to either of those. It does not winter-kill, and can survive greater heat. It will even flourish on waterlogged land, and consequently is suitable for cultivating under irrigation. Unlike these species also, it does not succumb to clover-sickness, and can be grown continuously on the same land. The growth is erect when crowded,

reaching a height of 2½ feet, but spreading where isolated. It is shallow-rooted, and therefore must have moist land; drought, even in a mild form, will quickly prove fatal. It somewhat resembles white clover, and its growth begins a little later in the spring than red

Alsike Clover (*Trifolium hybridum*).

clover. It can be sown with a nurse crop either in spring or autumn. The cultivation required is practically the same as in the case of red clover, but, as the seeds are very small, only about half the quantity would be required as for a similar area of red clover. Fields last

sometimes to the sixth year, but the plant has reached its maximum value by the third year. It can be cut for hay over a longer period than any other clover, as the main stem continues to grow with the production of new flowers. It is best harvested when in full bloom,

Red Clover (*Trifolium pratense*).

and, if possible, in moist weather, so that loss by shattering may be avoided. The hay is more leafy than red clover, and consists of about two-third leaves and one-third stalks. Alsike yields less seed to the acre than either of its supposed parents. The seed can be

readily distinguished from that of red or white clover by its smallness and by its being somewhat heart-shaped. Germination is rapid, being from two to six days. Dodder is the most dangerous impurity, which can become associated with this and other forage plants. Cocksfoot and perennial rye grass both give excellent results when mixed with it.

B.—Biennial Species.

Trifolium pratense, L. Red Clover.

Red clover is important because of its high food value, and because it can be well employed in rotations. It is indigenous to the greater part of Europe and Northern Africa, and also to parts of Asia Minor and Siberia, but it is comparatively modern as a fodder crop, being first known in the thirteenth century, and it did not attain any considerable degree of popularity throughout Europe until about fifty years ago.

There are a great many varieties. They are easy to cultivate, adapting themselves to most soils, and only exacting the one condition —that the areas be well drained. While special conditions for cultivation are not essential, still, some are more favorable, and it has been observed that clayey soils of a sufficient depth to allow of the development of an extensive root system will yield best results. It flourishes in cold districts, but cannot withstand drought. It may be sown in orchards for green manure, but being only a short-lived plant, it is advisable to consider it an annual, as if treated as a biennial it may not withstand the competition of summer weeds, the most destructive of these being dodder, curled dock, Californian thistle, ox-eye daisy, sterile brome grass, barley grass, cat's ear, and dandelion.

Individual plants, however, have been known to last several years when not grazed, but never to survive after a seed crop has been harvested from them. It has globular flower heads of compact formation and purplish in colour. The plants can always be distinguished from other species by a distinct white horseshoe which shows plainly on the leaves.

In America, where this plant ranks high in favour with agriculturists, two varieties of this very variable species are accepted as being sufficiently defined for classification, viz., *medium* and *mammoth*. The former, botanically known as *Trifolium medium*, is, indeed, of so distinctive a zigzag growth that it should scarcely be classed with red clover at all. It will produce both a hay crop and a seed crop during the one season when sown by itself, but will not (as before mentioned) survive the seed crop. It will, however, when sown with grass mixtures, live two or three years.

Mammoth red clover (*Trifolium pratense perenne*) has not been grown so much, probably on account of its lateness, but it is used for cultivating with Timothy grass as the flowering time of the two coincide. On account of its greater height it yields, if sown alone, considerably more hay than the medium variety, and if a seed crop is not required during the year would prove the more profitable to

cultivate. Still another point in favour of the mammoth is that it is much more productive on poor or sandy soils than is the medium. As the seeds of these two varieties cannot be distinguished with certainty, it is advisable to observe the plants in growth, and the following characteristics will give as satisfactory an indication of their variety as it is yet possible to secure. The medium red clover will be found to bloom quite a fortnight sooner than its larger relative; its stems are hollow with heads often in pairs, and stiff short pedicels or flower stalks. It derives its sustenance mainly through the tap-root, which sends out very few branches. Mammoth red clover, however, manifests some distinctly opposite characteristics, having solid stems, heads very seldom in pairs, and long drooping flower stalks, while its tap-root sends out a considerable number of branches which may probably account for its longer life. Abundance of insect life is essential to success in producing seed from red clover. We have probably a plentiful supply of native insects in Australia which would assist in the carrying on of clover pastures, but American observations have shown that the bumble or humble bee contributes very largely to the success of pollination, tests showing as high as 45.7 per cent. fertility. The bumble bee was introduced into New Zealand some years ago for the fertilization of clover seed, and the experiment has proved remarkably successful. It has been suggested that this useful insect should also be imported into Australia.

Red clover deserves far more extensive cultivation in Australia. The seed should be planted shallowly, about 1 inch in clay soils, and about 1½ inches in sandy soils (that is, of course, where special preparation for the crop has not been made), but where the soil is particularly suitable ½ inch in depth would be found to give even better results by producing plants of greater root depth. One pound contains about 250,000 seeds; therefore, if sown at the rate of a pound to the acre, evenly scattered, it would give about four and a half dozen plants to the square yard. Lime and phosphatic fertilizers are beneficial to red clover. The plant itself will add greatly to the fertility of the soil by the introduction into it of supplies of humus and nitrogen.

For use as green feed it is best cut before blooming, but if required for ensilage it is advisable to wait until the heads begin to discolour. It may be then run through a cutter and ensiled. If treated rapidly after mowing it will keep for years and retain all its original sweetness. The straw of red clover has very little food value, but it makes excellent bedding for animals.

The plant is subject to some diseases, mostly of fungus nature, but fortunately none of these is likely to be sufficiently harmful to prove a menace to its culture. Some little knowledge of these diseases is however essential. The most destructive one is clover anthracnose (*Colletotrichum Trifolii*) which attacks the stem, forming purple spots which increase in size until the stalk is completely engirdled, and thus effectively choked off. The stems are also subject to stem rot (*Sclerotinia trifoliorum*), and the roots may be attacked by root rot (*Rrhizoctonia violacea*), while the leaves are prey to a number of minor

diseases such as leaf spot (*Pseudopeziza trifolii*), black spot (*Polythrincium trifolii*), powdery mildew (*Erysiphe polygoni*), downy mildew (*Peronospora trifoliorum*), and clover rust (*Uromyces striatus*).

C.—Annual Species.

Trifolium incarnatum, L. Crimson Clover.

Crimson clover, also known as scarlet, carnation, or incarnate clover, is an annual of rather obscure origin, and is variously repated as originally native to Germany, Italy, and France. It is not so important as the perennials. It is of greatest value as a winter crop. Under favorable conditions it will attain a height of 3 feet, with a corresponding root depth. When given sufficient room the plant will develop as many as twenty stems, but when thickly sown it is apt to be singled stemmed, with very little foliage. The flower heads, of thick cylindric form and tapering point, are generally bright scarlet in colour, but occasionally rose pink, yellow, and even variegated ones are found scattered through a field, and as crimson clover is self-pollinated it is easy to separate the various colours for self-cultivation. The flowers, attractive to the eye, are also greatly sought after by the bees.

Abundant moisture is necessary for successful growth of crimson clover. As a crop for autumn sowing it ranks paramount, but can easily beaten by red clover and alsike as a spring crop. It will withstand shade better than any other species, and can be recommended for the fact that constant planting does not render the soil clover-sick. It is of remarkably rapid growth, and on this account it cannot be sown with a nurse crop in spring, but for autumn planting in suitable districts it can be broadcasted with rye, barley, or winter oats for green stuff. It adapts itself to nearly all soils, provided they are sufficiently moist, but poor sandy soils do not usually contain sufficient humus to insure good development. Home-grown seed has been found to give the most satisfactory results. The best time to sow is undoubtedly early autumn, which with reasonable rainfall should allow of a good growth before frosts set in. Ample moisture is essential till plants become established. It is more frequently sown alone, but where mixed in equal parts with oats, rye, or barley produces considerably more green stuff than when grown alone.

Although it is not desirable generally to plant crimson clover with root crops, one idea has been tried with fair success. The method is to lightly broadcast the field of clover seed with turnip seed (about 1 lb. to the acre) before harrowing. Soon it will be found that the quick-growing, large-leaved turnips shelter the young clover from the hot sun. Later they may be pulled up and gathered, leaving the clover, which will have become well established, in possession of the field. If required for seed it should be cut as soon as ripe; the best method being to mow in the early morning when slightly moist, and dry in small heaps to avoid loss by shattering. Unhulled seed, which is the best, may be secured by thrashing. Care must be taken that the mown crop does not get wet, as clover seed sprouts quickly, and serious

loss would soon become manifest. The seed itself is larger and more rounded than many other clovers. When fresh it is pink and glossy, becoming dull and brown when perished. It will be found to give a very high percentage in purity and viability when fresh, but loses its viability rapidly, and may be considered worthless after two years. When not too greatly intermixed with troublesome impurities, such as curled dock, wild carrot, ribwort plantain, fumitory, reflexed amaranth, and fetid hawk's beard, one pound of crimson clover should contain about 140,000 seeds.

As a green manure crop it is most valuable. *Firstly,* owing to rapidity of growth it can be turned into the soil sooner than other green manures, thus permitting early planting of corn and similar crops, and because it produces considerably more herbage. *Secondly,* because of its high nitrogen content. Like other legumes it is enabled by micro-organisms functioning in nodules upon the roots to fix the free nitrogen of the atmosphere permeating the soil. This fixed nitrogen is stored up in the tissues of the plant, and becomes available for future crops when decomposed after being ploughed in. On pasture land a considerable amount contained in the herbage is returned to the soil in excreta from stock, and where a hay crop has been reaped there still remains a large amount of nitrogen in the roots and stubble to enrich the ground. For soils deficient in nitrogen the growth of crimson clover will be found a rapid and economical way of making good the deficiency. *Lastly,* because by deep penetrating roots it draws mineral food from the subsoil for its own subsistence, which later enriches the top-soil, and is thus brought within reach of shallow rooting plants. It must not be forgotten also that crimson clover occupies the ground only during a period of the year in which it would not otherwise be in use. For instance, if planted immediately after early potatoes it will yield a profitable crop for hay or ensilage, and leave the ground in a fertile condition for planting of corn or late potatoes. By systematic use of crimson clover farmers can increase the productivity of their land, and poor patches may be brought to a high state of fertility. As before stated crimson clover will grow on almost any soil, provided it be sufficiently moist, but on poor sandy soils it is advisable to give the land a dressing of lime and superphosphate, so that the clover may get a good start. The soil should be worked to a fine level, firm condition before planting, sown at the rate of about 5 lbs. to the acre, and then very lightly covered with a brush-harrow. The brush-harrow is an implement which any farmer can make for himself. It consists merely of a wooden frame with branches of bush fixed in so that when drawn over the ground the twigs act as a light broom and just cover the seed.

Trifolium Subterraneum, L. Subterranean Clover.

This article would not be complete without some mention of Subterranean Clover (*Trifolium subterraneum*), which is probably so called because its lower stems force their seed pods into the ground in readiness for future propagation. This species is an exotic and native of Europe, Asia, and Africa. It is highly esteemed by some pastoralists, because it supplies such a large quantity of feed very early in the

season. The green feed is a succulent nitrogenous fodder greatly relished by all kinds of stock which eat it in preference to natural grasses, but subterranean clover usually sprouts with the first autumn rains, and in a week will produce a dense turf before many other grasses appear. It dies down again early in the summer, and on this account is deprecated by some farmers who consider the period of growth too short. They should not, however, lose sight of its virtues, for not only does it reproduce itself, so that when once introduced into a field there is no need of further sowing, but it spreads with such rapidity as to stifle all noxious weeds in its course, and this latter quality alone should make it valued.

On volcanic soil it will grow to enormous proportions, but in an ordinary field it creeps along the ground with stems of about 18 inches in length bearing large leaves showing distinct white markings and sometimes very hairy. The flowers are not so attractive, being small white heads borne insignificant clusters on long straight stalks which curve backward as the seed pods ripen, many becoming forced into the ground and others remaining strewn upon the surface. Sheep are very fond of these seed vessels, and often derive considerable nourishment from them in the droughty summer months after the plants have died off. In the cooler districts of our own State, such as Gippsland, it may be safely regarded as one of the best of our naturalized fodder plants. It grows well in the moist valleys along the watercourses, where it remains fresh and green well into the summer months. Good quality soil such as that, however, is not essential for subterranean clover as it will flourish on relatively poor, dry sandy or gravelly land when the rainfall is over 20 inches annually.

The Soil and its Preparation.

Most clovers require fairly good land, and though some varieties can be raised with profit on poor soil they do not yield such splendid crops as when grown on richer areas, especially moist alluvial flats. Clayey soils and loams give good crops, but sandy soils do not usually prove so satisfactory, because owing to their loose nature they do not hold sufficient moisture, and generally speaking they are also of poorer quality. Land for clover must be well drained, for while the plants like moisture they cannot withstand damp. In preparation for planting the ground must be most thoroughly worked. It should be deeply ploughed and harrowed to the utmost degree of fineness, then rolled until perfectly level and firm.

Manuring.

Liberal manuring with phosphates will be found necessary on poor soils. Lime is useful, and can be applied at the rate of 1 ton to the acre. Nitrogenous manures are not usually necessary, as the plants collect this element for themselves from the air through the agency of bacteria. Occasionally a little may be needed to maintain the plants until established, and when required sulphate of ammonia at the rate of ½ cwt. to the acre may be applied.

THE FOLLOWING SPECIES OF TRIFOLIUM HAVE BECOME NATURALISED IN VICTORIA.

No.	Scientific Name.	Vernacular Name.	Natural Order.	Year of Naturalisation.	Original Habitat.	Characteristics.
1	*Trifolium angustifolium.* L.	Narrow-leaf Clover	Leguminosae	1907	Europe and Asia	Annual, of very slight pasture value
2	*T. arvense.* L.	Hare's-foot Clover	,,	1887	Europe, Asia, and Africa	Annual, of only slight pasture value
3	*T. fragiferum.* L... ..	Perennial Strawberry Clover	,,	1903	Europe, Asia, and Africa	Perennial, a good pasture plant, well suited for moist ground
4	*T. glomeratum.* L. ..	Clustered Clover ..	,,	1892	Europe, Asia, and Africa	Annual, useful in spring on dry sandy soils
5	*T. hybridum.* L.	Alsike Clover ..	,,	1908	Europe, Asia and Africa	Perennial; a good fodder plant, useful for swampy ground
6	*T. incarnatum.* L. ..	Carnation Clover ..	,,	1908	Europe ..	Annual or biennial; a good pasture plant, useful in silage; the flowers are much frequented by bees
7	*T. minus.* Rel.	Slender Clover ..	,,	1864	Europe ..	Annual; usually too small to be of much use as a fodder plant
8	*T. parviflorum.* Ehrh. ..	Small-flower Clover	,,	1903	Europe, Asia, and Africa	Annual; of slight pasture value on poor soils
9	*T. pratense.* L.	Red Clover ..	,,	1864	Europe, Asia, and Africa	Biennial; a good fodder plant, useful as a rotation crop
10	*T. procumbens.* L. ..	Yellow or Hop Clover	,,	1864	Europe, Asia, and Africa	Annual; useful on poor, dry, or sandy soils
11	*T. repens.* L.	White Clover or Dutch Clover	,,	1864	Europe, Asia, and Africa	Perennial; a good pasture plant, useful on almost all soils; the flowers are the delight of bees
12	*T. resupinatum.* L. ..	Annual Strawberry Clover	,,	1887	Europe, Asia, and Africa	Annual; of slight pasture value on poor soils
13	*T. Scabrum.* L.	Rough Clover ..	,,	1907	Europe, Asia, and Africa	Annual; of very slight pasture value
14	*T. striatum.* L.	Knotted Clover ..	,,	1907	Europe and Asia	Annual; of slight value on poor, dry, or sandy soils, but not a good clover
15	*T. subterraneum.* L. ..	Subterranean Clover	,,	1887	Europe, Asia, and Africa	Annual; a valuable fodder plant in moist districts
16	*T. tomentosum.* L. ..	Wolly-headed Clover	,,	1887	Europe, Asia, and Africa	Annual; of slight use in spring on poor soils, but not a good clover

THE FOLLOWING SPECIES OF MEDICAGO AND MELILOTUS HAVE BECOME NATURALIZED IN VICTORIA.

No.	Scientific Name.	Vernacular Name.	Natural Order.	Year of Naturalisation.	Original Habitat.	Characteristics.
1	*Medicago denticulata.* Willd.	Burr Medick ..	Leguminosae	1864	Europe, Asia, and Africa	Annual; useful in spring on unimproved pastures
2	*M. hispida.* Gaertn ..	Rough Medick ..	,,	1907	Europe ..	Annual; useful for winter pasturage
3	*M. lupulina.* L.	Black Medick ..	,,	1864	Europe, Asia, and Africa	Annual; a useful pasture plant, well suited for moist situations
4	*M. maculata.* L.	Spotted Medick ..	,,	1887	Europe, Asia, and Africa	Annual; useful for winter pasturage on sandy or clayey soils
5	*M. minima.* L.	Small Burr Medick	,,	1907	Europe and Asia	Annual; useful in spring on dry sandy soils
6	*M. orbicularis.* All. ..	Button Clover ..	,,	1907	Med. Reg. ..	Annual; a good pasture plant; it has large smooth pods
7	*M. sativa.* L.	Lucerne or Alfalfa	,,	1864	Europe and Asia	Perennial; a useful pasture plant, cultivated throughout the Australian Continent
8	*M. scutellata.* L. ..	Snail Clover ..	,,	1907	Med. Reg. ..	Annual; a good pasture plant
9	*M. tribuloides.* Desr. ..	Caltrop Medick ..	,,	1907	Europe ..	Annual; of slight pasture value
10	*Melilotus alba.* Desr. ..	Bokhara Clover or Sweet Clover	,,	1908	Europe and Asia	Biennial; a good fodder plant; it will thrive in all types of soils
11	*M. parviflora.* Desr. ..	Small-flowered Melilot	,,	1887–8	Europe, Asia, and Africa	Annual; useful to improve soils of a sandy nature

WEEDS AND THEIR ERADICATION.

By H. W. Davey, F.E.S.

At the present time in Victoria there are enormous areas of land that are more or less heavily infested with noxious or useless vegetation, and the question of its control is one of the first importance. The weed problem is always a difficult one, even in the old settled lands, but in a country like Australia with its vast unoccupied spaces the problem of controlling undesirable alien plants presents difficulties unknown in thickly populated countries. Further, in a favorable climate such as exists in Victoria, the absence of any real winter favours the growth of most plants. In Europe St. John's Wort usually occurs as a hedge plant among others, which shelter it during the severe winter months. In the summer it has to compete for moisture with the neighbouring plants and trees; this has caused it to evolve a wonderful root system. In the absence of any deep freezing of the ground here in the winter the roots grow stronger and deeper, and consequently almost quite drought-resistant.

Again, a plant usually is more liable to become a serious pest in a country to which it is introduced than in that to which it is indigenous. For one reason it mostly leaves its natural controls behind. The blackberry in England has numerous enemies, both fungi and insects; some of the latter may partially defoliate it, others lessen its seed production by attacking its blossoms, while some reduce it in size by tunnelling its stems, whereas Victorian insects have so far left it severely alone. On the other hand the imported fox and starling, by feeding on the ripe berries, are distributing its seeds over very wide areas.

Insect Control.

An opinion held by many people is that insects can be imported which will be capable of controlling St. John's Wort and other harmful weeds. Insects undoubtedly do check the undue multiplication of plants, but nature never exterminates species in this manner. The most that insects can do is to prevent the undue increase of certain plants, while at the same time these insects are themselves subject to control, which keeps them also in check, and thus the balance of nature is preserved. If, however, insects were imported for the purpose of controlling any specific plant, these to be of any service, would themselves have to be introduced free of controls, and this would disturb the balance of nature. An insect to be of any value for this purpose would, of course, have to be a vegetable feeder, and introduced free from parasites. Freedom from control by parasites would allow the insect to increase enormously in numbers, especially while its host plant was plentiful, as after all the food supply is always the governing factor.

Now, even supposing that an introduced insect was perfectly successful in exterminating its host, it would be forced to seek its food from other plants (some of which might be of great value to man) or else perish. But, as has already been said, nature does not permit the extermination of species. What would happen in the event of the plants which it was introduced to attack becoming scarce, is that the

insect would, in all probability, acquire other tastes in food and thus itself become a greater calamity than the plant it had assisted in controlling.

What is a Weed?

The question is often asked, What constitutes a weed? Just as dirt is sometimes defined as matter out of place, for present purposes we may consider a plant to be a weed when it is growing where it is not desired. Thus potatoes would be weeds if growing in a wheat crop and *vice versâ*.

Weeds as Hosts for Insects and Fungi.

Another important phase of the question is that weeds act as hosts for various species of insects and fungi. This may not be of much importance when weeds are very distantly related to plants of economic value, but it becomes of the very first importance when they are both of the same family or genus. Take, for example, the Cruciferæ, to which family the cabbage and its kindred belong, several most pernicious weeds such as Charlock (*Brassica*), Shepherd's Purse (*Capsella*), and Hedge Mustard (*Sisymbrium*) belong to this family. These weeds act as hosts for diseases, both insect and fungi, that attack market garden produce. The stem-eelworm (*Tylenchus devastatrix*) is stated to live in the Sow Thistle (*Sonchus*) as is also a fly belonging to the Phytomyzidæ, a species of which is very commonly seen on this plant in Victoria in late spring. Later in the season this fly attacks sunflowers and other members of the Compositæ. Several other destructive insects and fungi that feed on cultivated plants use various weeds as hosts, from which they emerge to attack orchards, market gardens, and farm crops.

How Weeds Spread.

Seeds are spread in such numerous ways that many weeds are now cosmopolitan. Probably the most common means by which seeds are brought to a country is through the importation of impure seed and by ships arriving in sand ballast, the ballast being afterwards used for reclaiming foreshores, &c. Once introduced, they spread themselves over the land by innumerable agencies, the chief of which probably are as follows:—By the wind; by stock movements from one part of the country to another, either by road or train (the animals having hooked seeds attached to their coats, or clinging to or imbedded in soil contained in their hoofs); by animals feeding on plants containing ripe seed, which passes through the digestive tract, but still retains its viability; by birds ejecting indigestable portion of their food, which often contains many seeds.

Starlings, in addition to their many other offences, are spreading the seeds of African Boxthorn far and wide, owing to their partiality for the fruit of this plant. It is claimed by some people that parrots help the spread of St. John's Wort by their carrying off small bunches of the ripened seed vessels for the sake of the seeds they contain. The writer has not been able to verify the accuracy of this statement, but when the extreme smallness of the seed is considered, it would appear improbable that parrots would trouble themselves over such minute particles of food.

Foxes and rabbits spread many plants by carrying seeds in their fur; the rabbit, in addition to acting as a distributing agent for the seed of many bad weeds, also favours their growth and subsequent seed production by eating out grasses that otherwise would enter into competition with them.

Irrigation channels, unless the banks are kept free of weeds, offer great facilities for the dispersal of seeds. The ripe seeds fall into the water and may be carried long distances. These later are spread over land that is being watered from the channels.

Classification of Weeds.

Weeds are commonly classified into three main classes, viz., Annuals, Biennials and Perennials.

An annual is a plant that comes up from a seed, bears flowers and seeds and then dies, completing its life cycle in one year. Familiar examples of annual weeds are Spurrey, Dodder, Charlock and Poppies (Papaver).

A biennial grows from a seed and completes its life cycle in two years. During the first year of its growth it usually produces a tuft or rosette of leaves, at the same time strengthening its root system, and in the second year of its life produces flowers and seeds and then dies. Foxglove and Hemlock are examples of biennial weeds.

A perennial is a plant that lives on for a number of years and usually produces flowers and seeds every year. St. John's Wort and Canadian Thistle are examples.

In addition to propagating themselves by seeds, many weeds are spread by means of creeping root stocks, bulbs, and corms.

Control of Weeds.

Before the question of "weed control" in Victoria can be dealt with as it should be, it will first be advisable to take a census of all proclaimed plants. This would enable the strongholds of our worst weeds to be known, and also the centres from which they were spreading to clean areas. In such a work the various Shire Councils could afford most valuable assistance. Steps could then be at once taken to extirpate dangerous plants before the infestation became too extensive, and the cost of their eradication prohibitive.

No magic wand can be invoked to cause weeds to disappear. The way of eradication is rather by hard work, and hard work applied at the right time. For instance, it is merely a waste of labour to cut down an annual weed after it has shed its seed; it would have died a natural death if left undisturbed, having already fulfilled its mission in producing seed for the continuation of the species.

The first three main principles of weed control are—

First. Preventing the introduction of weed seeds, as prevention is better than cure.

Second. To prevent weeds from ripening seed.

Third. Preventing perennial weeds from making top growth.

Weeds carrying ripe seeds should never be ploughed under, as most of these seeds will lie dormant until again brought to the surface by later cultivations. If possible, ground should be burnt off before ploughing;

this in itself will suffice to destroy the seeds of some plants. The most vulnerable time to attack perennial weeds is when they have reached the flowering stage and just before the seed is formed.

Cultivation, where it can be carried out, is a most effective method of destroying weeds, but unfortunately this is not always possible. Where weed-infested land can be brought under the plough, and cultivation given at short intervals the most obstinate plant can be destroyed, for if the leaves are kept from forming, the plant is unable to elaborate the crude sap sent up by the roots and it will starve.

The crude root sap has to be manufactured into plant-building material by means of that green coloured protoplasm called chlorophyll, which works in sunlight, and unless the plant has leaves, it is unable to deal with the sap sent up by the roots for elaboration and return.

The mistake is often made of allowing too great an interval of time to elapse between the cultivations, with the result that fresh leaves are again formed. These immediately take up the interrupted work of sap elaboration and thus give the roots a fresh lease of life.

(To be Continued.)

ELECTRIC FARMING.

At least 10,000 farms, says the New York *Sun,* will be supplied with light and power when the great electric plants now being constructed by the Ontario Government are completed. The Government already owns and works thirteen distinct systems scattered over the province, and distributes 365,000 h.p. of electric energy derived from water. Another 110,000 h.p. will soon be provided by the Queenston-Chippewa plant on the Niagara River It will have an ultimate capacity of 525,000 h.p. Experts who have been studying the problem of electrical equipment for farms declare that electricity will banish the farmers' usual grumbles against the weather, simply because the work can be done much more quickly in preparing the ground and cultivating the crops. During haymaking the grass can be mown and if rain threatens can be dried and gathered by electricity without the need of the sun. There have been many attempts to assist the growth of crops with electricity in England, and the results have been varied; but a new system has recently been tried at the Rothamstead Scientific Farm, near Harpenden, Herts., and has had considerable success. A network of wires was erected over growing barley about 10 feet from the ground, and currents of 15,000 volts were passed through the corn. Various kinds of discharges were tried, and though no final decision has been arrived at, it appears that the average increase of growth caused by the electrical discharges is about 21 per cent. That is not enough to make the electrical treatment of crops a commercial proposition, but a very little greater increase would pay, and it is hoped to achieve it.

PEACH-GROWING IN VICTORIA.

(Continued from page 604.)

By A. G. McCalman, Orchard Supervisor.

Insect Pests—*continued.*

The Cherry Borer.—This is the larva of a large, light-coloured moth, which bores into the butts and limbs of peach and other stone fruit trees. The grub is whitish in colour, and grows to a length of about 1½ inches. It begins its destructive work by eating the bark, generally where two limbs join or on the butt of the tree. Its excreta, and the web which it weaves form a covering, and under this it tunnels into the wood. Small limbs are frequently girdled, and gradually die.

The grower should be on the watch for sawdust-like matter excreted by the grubs, so that they may be destroyed before they have bored into the wood. The grub can generally be destroyed by pushing a piece of thin copper wire into the hole, but plugging up the hole with soap will suffice.

Fungus Diseases.

The curl leaf fungus (*Exoascus deformans*) is one of the most injurious with which the peach-grower has to contend, and it is well known in all the peach-growing districts. Both the leaves and the twigs are attacked. When the leaves just appear in the spring the affected ones show pink edges, and later the leaves pucker up, the tissues become thickened, and often very much enlarged. These leaves turn yellow, and later have a whitish appearance owing to innumerable spore cases having burst through the epidermis of the leaves.

These diseased leaves then fall, and the tree may become completely defoliated. A new crop of leaves will appear, but not with the same power of forming fruiting buds for the ensuing year, as the tree has had a severe shock through the loss of the first crop of leaves. The twigs also are often badly distorted and discoloured by the fungus.

In order to deal with the curl leaf successfully, it is essential to spray before the leaves appear, as once these become affected it is impossible to cure them. The following fungicides may be used to control the disease—Copper-soda mixture, Bordeaux mixture, lime-sulphur spray, and bluestone alone. Experiments carried out by departmental officers at Drouin in 1918 showed copper-soda mixture to be the most reliable, but in the drier districts of northern Victoria the spray usually applied is bluestone alone, used at the strength of 1 lb. of bluestone to 20 gallons of water. This should be applied when the buds begin to swell, about the last week in July.

Copper-soda is made as follows, and should be applied when the bloom-buds are just showing pink.

Dissolve 6 lbs. of bluestone (sulphate of copper) in 25 gallons of water in a wooden or copper vessel. In another vessel dissolve 8 lbs. of washing soda in 25 gallons of water. Pour the solutions evenly and at the same time through a copper strainer into the barrel of the spray pump; stir thoroughly, and keep agitated while using. This mixture should be used on the day it is mixed. An addition of 5 ozs. of casein to the mixture increases its spreading power and adhesiveness. As iron is attacked by bluestone iron vessels should not be used in making this or other bluestone mixtures. Casein should be mixed only with an

alkaline mixture of Bordeaux or copper-soda, and not with pure bluestone.

A convenient method when using much of this spray is to make a stock solution of bluestone, dissolving a pound to each gallon of water, and doing the same with the washing-soda. Six gallons of this bluestone solution are diluted to make 25 gallons, and 8 gallons of the soda solution also diluted to make 25 gallons, and then mixed as previously described. Bluestone may be dissolved by stirring in boiling water, allowing 2 gallons to 6 lbs., or else by suspending it overnight in a hessian bag just under the surface of a barrel of cold water. It should be diluted with cold water before using. Bordeaux mixture is made in a similar manner to copper-soda, but 4 lbs. of fresh (lump) lime is used instead of washing soda. The lime is slaked by placing in a bucket or tub and adding water slowly till it breaks down into a powder. More water is then added, and it is stirred up, making milk of lime. This is then diluted to make 25 gallons. As lime varies in quality it is advisable to test the Bordeaux mixture with blue litmus paper after mixing. If the paper turns slightly pink when dipped in the mixture it is evident that it is neutral and safe to use. If the paper turns distinctly pink, it shows that the mixture is acid, and a little more lime should be added. Another method of testing is to hold a clean knife-blade in the mixture for about a minute; if a deposit of copper shows on the knife-blade when held up to the light more lime must be added.

Commercial lime-sulphur spray is an effective fungicide, and has the additional advantage of destroying San José and other scale insects. It should be used at the rate of 1 gallon to 12 of water when the buds are swelling.

Some varieties of peaches, including Elberta, Kia-Ora, Lady Palmerston, and Sneed, as well as most of the nectarines, are very subject to curl-leaf, and copper-soda should be used preferably for such, especially in the wetter districts, where the fungus is more difficult to control.

Shot-hole fungus (*Phyllostida circumcissa*).—This disease derives its name from the appearance of the affected leaves which show numerous roundish holes. It attacks other stone fruits, and in the apricot causes the well-known scabbing of the fruit. It is usually kept sufficiently in check on peach trees by the spraying for curl-leaf, but another spraying after the fruit has set may be necessary in some seasons. For this, use commercial lime-sulphur at the rate of 1 gallon to 50 of water, or Bordeaux mixture made with 2 lbs. of bluestone and 2 lbs. of lime to 40 gallons of water.

Prune Rust (*Puccinia pruni*).—This is recognised by the numerous brown pustules which appear on the under side of the leaf, the upper side showing small yellow spots. The fruit also is often attacked, and rendered unsightly by the brown spots.

The time of attack varies from early to late summer. This makes it difficult for the grower to know when to spray, and he generally trusts to the usual application for the curl-leaf to keep the disease in check. Lime-sulphur at the rate of 1 gallon to 50 of water or the weak application of Bordeaux mixture suggested previously for shot-hole, if given at the first appearance of the disease will keep it in check, but these should not be applied when the fruit is nearing the ripening stage.

Peach Freckle (*Cladosporium carpophilum*).—This disease shows as black spots or "freckles" on the fruit, and has only been found in wet districts. The treatment is to spray with copper-soda or Bordeaux mixture when the buds begin to show pink, and again with weak Bordeaux

mixture (2 lbs. bluestone, 2 lbs. lime to 40 gallons) after the fruit has set. Diseased fruit should be destroyed.

Brown Rot (*Sclerotinia cinerea*).—This is not a new disease, but has only recently come into prominence, having caused great losses to growers in some parts of the State in the past season (1920-1921). It attacks all stone fruits, generally when it is ripening, but it may occur at the blossoming stage. Blossoms, leaves, fruit, and twigs are all affected. On the fruit the disease appears as a small brown spot which increases in size until the whole fruit becomes brown and soft. These finally dry and turn ash-coloured, and shrivel and harden. They are known as mummies, and should be destroyed. When attacked the blossom turns brown and falls off. The fruit is sometimes attacked when half-grown, but generally when it is ripening, and the spread of the disease is sometimes so rapid that a whole crop may be destroyed in a few days.

Experiments in the control of this disease are being carried out by officers of the Department of Agriculture, and it is hoped that some sure method of dealing with it will be found. The usual spraying in the spring should be carefully attended to.

Armillaria Mellea.—This is a fungus which attacks the roots of peaches and other trees. A net-work of black strands resembling black string forms on the roots, and the bark when stripped off has a white felty appearance.

The disease works up along the roots to the butt of the tree, which eventually dies. The disease is found on the native timber, and its presence in an orchard is an indication that the roots left in the ground when the land was cleared were affected. Bush land intended for planting should have all the roots removed as far as possible, and two years should elapse before planting is done. When badly affected trees are found in an orchard they should be grubbed out and burned on the spot, care being taken to remove all the roots. If a tree be slightly affected on the roots the ground should be carefully removed so as to expose the roots; the diseased ones should be removed, and the others should be sprayed with a solution of sulphate of iron at the rate of 1 lb. to 4 gallons of water; Bordeaux mixture and lime-sulphur may also be used for this purpose. If the butt of the tree be affected, the diseased part should be carefully cut out, and the following mixture applied with a stiff brush:—Dissolve 1 lb. of bluestone in 1 gallon of water. Slake 2 lbs. of fresh (lump) lime, and mix in half a gallon of water. When both the bluestone solution and lime wash are cold mix together and use. This mixture should be used within two days of mixing.

Attention to drainage assists in keeping this disease in check, as will an occasional dressing of lime.

A useful table prepared by Mr. P. J. Carmody, the Chief Orchard Supervisor, giving times to spray for various orchard diseases was printed in the August number of the *Journal of Agriculture* for 1921. Reprints of the table have been obtained, and copies may be had from the Department of Agriculture.

Casein when used for adding to Bordeaux mixture is used at the rate of 5 ozs. to 50 gallons. Mix it dry with a few handfulls of slaked lime, and stir this in half a gallon of water till the casein is dissolved.

For the copper-soda mixture dissolve the casein in a pint of water in which 2 ozs. of washing-soda has been dissolved.

(*To be continued.*)

THE CULTIVATION OF MAIZE.

Maize, which is the principal crop of the United States of America, is cultivated to a limited extent only in Victoria, the average annual acreage sown for grain being approximately 20,000 acres. But this acreage by no means represents the total area suitable for the production of such a valuable crop, and there is no apparent reason why the area should not be considerably extended.

Maize is grown for both grain and fodder. The grain is used as a human as well as a stock food, while the herbage is fed to stock as green fodder or in the form of ensilage.

There are five main types of maize, viz.:—Pop, Dent, Flint, Soft, and Sweet. Of these there are but two types of practical importance in Victoria—the Flint and the Dent—the others being grown to a limited extent only.

Varieties.

The fact that maize is a plant easily cross-fertilized, and consequently only with difficulty kept pure, and also that any variety will change materially in a few years if grown under greatly different conditions, accounts for the existence of the very large number of the more or less distinct varieties now grown.

The intending grower should be careful to choose the variety best suited to his peculiar conditions of soil and climate. If there is any danger of early frosts occurring, late-maturing varieties should not be grown, but as these are usually the heavier yielders, early varieties should not be sown where the season is long. Where the season is long, but the latter half generally dry, early varieties may, however, prove the most profitable.

Description of Some Common Varieties.

1. Flint Types—
   (*a*) *Ninety-day.*—This is an early maturing variety. Has a short stalk, and is a comparatively light yielder.
   (*b*) *Longfellow.*—An early variety. Ear slightly tapering, 10 inches to 12 inches long, about 5 inches in circumference, rows 10 to 12. The grain is firm on the cob and yellow in colour.
2. Dent Types—
   (*a*) *Leaming.*—Medium early variety. Ears tapering, 8 inches to 9 inches long, 6½ inches to 7 inches in circumference, 18 to 24 rows, with medium to small furrows between them. Grain very tight on cob, rather thick, narrow and deep, dark amber colour, and with a smooth to slightly rough dent. Is one of the best varieties grown inland for fodder purposes, keeping green well into the autumn. Has a medium heavy stalk and good leaf.
   (*b*) *Eclipse.*—A variety somewhat similar to Leaming; medium maturing. Is suitable for late planting for silage.
   (*c*) *Sibley.*—A medium early variety, very popular in the Orbost district for grain. It is a good yielder, the cob being about 9 inches to 11 inches long with 16 to 20 rows. It is a smooth dent yellow maize.

(*d*) *Funk's Yellow Dent.*—Another variety grown largely in Gippsland. Cobs slightly tapering, 9 inches to 12 inches long, 7 inches to 8 inches in circumference; colour pale yellow, dent slightly rough. Under suitable conditions is a heavy grain yielder, and is also suitable as a fodder maize. Being a fairly late maturing variety, it should not be planted for grain where there is any danger of early frosts.

(*e*) *Brewer's Yellow Dent.*—This is another popular variety, being a heavy grain yielder and a good fodder maize. Ears average about 10 inches in length and about 7½ inches in circumference, with 20 to 22 rows. Is an early maturing variety.

(*f*) *Reid's Yellow Dent.*—A medium late maturing variety. Ears 9 inches to 10 inches long, and about 7 inches in circumference, with 18 to 20 rows of grain. The grains have a characteristic shape, being rather narrow and thick, and appearing somewhat square as seen in the ear. Butts and tips are usually well covered.

(*g*) *Yellow Moruya.*—A late maturing variety, fairly good yielder, grain large and flat. Is a very good fodder maize, being a tall growing variety, and producing a heavy crop of stalk and leaf.

(*h*) *Hickory King.*—A white Dent variety; late maturing. Is only a fair grain yielder, the cobs being small, with 8 to 10 rows of large, flat, smooth grain. Gives a very prolific growth of succulent foliage, and is very popular as a fodder maize.

(*i*) *Boone County Special.*—A medium early variety; ears cylindrical, 8 to 11 inches long, 7 inches to 8 inches in circumference, with 18 to 24 rows of white, moderately rough, deep grain. A useful variety for grain or fodder.

(*j*) *Cornplanter.*—A white Dent variety, resembling Boone County Special. It is a late variety, and is popular on the lighter soils at Orbost. Is a good all-round variety, giving a heavy yield of grain, as well as a large crop of excellent fodder.

Climate.

The most successful results with maize are obtained in districts where the growing season is long, warm, and moist. Unless irrigation water is available, a good rainfall during the summer months is essential. A sufficient supply of moisture is needed, particularly at the tasselling and cobbing stages, and if this cannot reasonably be expected there is but small chance of success.

In the wheat belt of Victoria, maize cannot be profitably grown except under irrigation. Maize is injured by frost at almost any stage of its growth, but particularly during the flowering and cobbing stages, and therefore it can only be grown in districts where, in normal seasons, frosts are absent during the growing period. The length of the growing period varies from three to six months, according to the variety grown

and the climatic conditions. For fodder maize, colder and shorter seasons will suffice.

Soil.

Maize succeeds best in a warm, deep, friable soil, well drained, and with a fair capacity for holding moisture. Rich alluvial river flats and drained swamps furnish the best conditions. Soils deficient in

Sibley Maize at Orbost.

organic matter are unsatisfactory, but may be improved by the application of stable manure or the ploughing under of green crops. The rich flats on either sides of the numerous rivers and creeks north and south of the main Dividing Range specially lend themselves to the production of maize, partly owing to the soil provided, and also to the climatic conditions prevailing. The summer season is hot enough and

long enough to ripen the crop, and, where temporary dry spells are experienced, water for irrigation is generally available.

Rotation of Crops.

At Orbost, the land has been continually cropped with maize for many years without any apparent diminution in yield. The soils here are, however, remarkably fertile, and their fertility is maintained by the fresh layers of silt deposited by periodic floods. With soils of average fertility, such practices would lead sooner or later to a serious decrease in yield. If maize-growing is to remain profitable, the soil fertility must be maintained. A suitable crop rotation, combined with stock raising or dairying, provides the most suitable means of keeping the land in good condition.

The most suitable rotation will depend on the local conditions, but it should preferably include a legume which, after being grazed off, should be ploughed in prior to seeding the maize.

Preparation of the Seed Bed.

No amount of working after the crop is planted can make up for poor preparation at the beginning. In many districts, it is necessary to plough the land early in autumn, or several months before sowing, in order to enable the soil to store a sufficient amount of moisture to produce a profitable crop. Where green crops are to be turned in, this should be done not later than very early spring, in order to allow time for their decay before the maize is planted.

As maize requires a fine seed bed, the land should, as the seeding season approaches, be worked to a fine tilth with the cultivator and harrows. The first working should be deep, and successive workings shallow, thus forming a firm, well-consolidated seed bed.

On stiff soils liable to run together, the land should be left in the rough until early spring, and then again ploughed. The second ploughing should be shallow, and the land then worked down to a fine tilth.

Time of Sowing.

Maize needs a warm soil for germination, and if sown too early in cold ground, the seed is liable to rot. Again, the young plants are susceptible to frost, so that it is necessary to defer sowing until all danger from this source is past. In the warmer districts, it is sometimes possible to begin sowing in September, but in cooler districts conditions are usually not suitable till October or early November. As the crop requires as long a growing period as possible to mature grain, it is important to sow as early as conditions permit. Slow-maturing varieties should not be sown in districts where early frosts are liable to occur. When grown for fodder, the seed may be sown any time during October, November, December, and early January.

Rate of Seeding.

Whether intended for grain or green fodder, maize is usually sown in drills. Broadcasting is sometimes practised, but, except in isolated cases, it is inferior to sowing in drills. The distance between the rows varies with the district, and whether the crop is grown for grain or

fodder. In average districts, rows from 3 ft. 6 in. to 4 feet apart, and with plants from 12 inches to 15 inches apart in the rows, will be found to give satisfactory results for grain; whilst for fodder a thicker sowing, 2 feet to 3 ft. 6 in. apart, and about 9 inches to 18 inches apart in the rows, with two or three seeds in each hill, is suitable.

A common practice at Orbost is to sow the plants 3 feet apart each way, dropping three seeds at each hill. The most suitable method for any district can, however, be determined only by experience and practical tests.

Wherever possible, planting in check rows is advisable, so that intercultivation can be done in both directions. The quantity of seed required depends, of course, on the method adopted, varying from 8 to 10 lbs. per acre for the thinner seeding up to 15 to 20 lbs. per acre. For fodder, an even thicker seeding may give good results.

A Well-filled Butt of Maize.

Method of Sowing.

(1) *Ploughing in.*—With this method, the sowing is done during the second ploughing—the seed being dropped by hand behind the plough in every fourth or fifth furrow. The ploughing should be shallow, or the seed will be buried too deeply. This method is only satisfactory where the land has been well prepared, is in good tilth, and free from weeds. It is also useful where the land is of a heavy nature, and has been beaten down by rain.

(2) *Maize Planter.*—This is easily the most satisfactory method. The depth of sowing and rate of seeding can be accurately regulated, and a much better job is obtained than with any other method.

(3) *Wheat Drill.*—With a wheat drill it is difficult to sow the seed thin enough for a grain crop, but it may be used when sowing for fodder. By blocking up some of the hoes, the required distance between the rows may be obtained.

(4) *Broadcasting.*—This method is permissible only where the crop is grown for green food or ensilage in good districts, and, even then, only

where the ground is unsuitable for the use of the drill. When sown broadcast and thickly, the sun cannot penetrate to the bottom, with the result that the lower leaves die off, the stem becomes woody and indigestible, the total yield is less, and the nutritive value is less also. Apart from these defects, the risk of disease is greater, and the inter-cultivation required is not possible.

Depth of Sowing.

The depth of sowing depends on the quality and moisture of the soil. For best results, the seed should not be covered with more than 1½ to 2 inches of soil, except when the surface is dry and it is necessary to plant deeper to reach moist soil. In heavy, stiff soils containing plenty of moisture at seeding time, 1 inch is sufficient.

An Ear well filled to the top.

Fertilizers.

Except under such special conditions as prevail on the flats along the Snowy and Tambo Rivers, where the soil is periodically supplied with fresh materials by siltation, some system of manuring is necessary to insure maximum yields of maize, and, at the same time, maintain the fertility of the soil. Where available in sufficient quantity, farmyard manure is of great value, particularly where the organic content of the soil is low. The ploughing under of green crops is another means of making up a deficiency of organic matter, and thus increasing the water-holding capacity of the soil. To replace the phosphoric acid removed by the crop, a dressing of some phosphatic fertilizer is required. Experiments have shown the application of a mixture of equal parts of superphosphate and bonedust, at the rate of 2 cwt. per acre, to be profitable. In certain soils, where the organic content is low, or where the rainfall is excessive, and large amounts of nitrates are washed out of the soil, nitrogenous fertilizers may give profitable results. In districts where the soil is deficient in lime, an application of 10 cwt. to 20 cwt.

A shapely Cob of Maize, with well-covered top and butt.

every four or five years may be necessary to insure maximum returns. It should be spread over the land after the autumn ploughing, and harrowed in.

Cultivation.

When the young plants are from 6 to 7 inches high, the land should be lightly harrowed in order to retain the surface mulch and destroy young weeds. From this stage until the crop reaches a height of 6 feet, it should be cultivated often enough to keep down weeds and to maintain constantly a loose soil mulch. To this end the cultivator should be used after any rainfall that cakes or crusts the surface. In using the cultivator during the earlier periods of growth, the teeth may be allowed to work at a depth of 3 to 4 inches without injury to young roots; but as the crop grows, the roots are found nearer the surface, and if these are injured the crop suffers. To avoid this, the cultivator should work shallower as the crop grows, until near the end the soil is merely skimmed. Deep cultivation in the earlier stages conserves the soil moisture —shallow cultivation in the latter stages conserves the maize roots.

Hilling.

Hilling it not recommended except where the maize is falling badly, or in districts where strong winds are prevalent. Where necessary, this operation should take place when the crop is about 3 feet high, and may be done with a plough or disc cultivator.

Suckering.

Although some varieties are inclined to throw out suckers, the effect on the yield of removing them does not, as a rule, compensate for the labour involved. It is, however, sometimes practised

for the sake of the green feed which is obtained. In removing the suckers care should be taken not to injure the main plant.

Harvesting.

(*a*) *Grain.*—The crop is allowed to ripen fully in the field, and picking takes place usually during May, June, and July, though some early varieties may be picked during April. The usual practice is to pick the ears and husk them at the same time, the cobs being then bagged and taken to the crib or barn to dry. A maize crib is a specially constructed shed enclosed by wire netting, provided with a floor raised 12 inches or so from the ground, and an iron or other roof. Cobs are thrown into the crib, and remain there for two to three months to thoroughly dry. They are then threshed by special maize shellers, generally during November and December. It is important that the grain be thoroughly dry before threshing, or it may mould in the bags.

(*b*) *Ensilage.*—If required for ensilage, the crop should be cut when the grain is just beginning to harden from the milk stage. At this time the plant as a whole has its greatest nutritive value, and the digestibility is highest. Where grown on a large scale, the crop is best cut with a special "corn binder," but on a smaller scale can be cut with a cane knife or hoe. Maize up to 7 feet or 8 feet high can be cut with the ordinary grain binder, but it is a heavy strain on the machine.

(*c*) *Green Fodder.*—Green maize makes excellent feed for dairy cows, and can be fed at any time, but the best results are obtained by cutting at the same stage as for silage. On an ordinary farm, this can best be arranged by making small successive sowings.

Selection of Seed.

It is a popular misconception among growers that it is beneficial to obtain their seed from another district. On the contrary, the effect of acclimatization on the yield of maize is so marked that a grower should always use his own seed, or at least seed grown in the same district by a reputable grower. By careful selection of seed each year, the yield can not only be maintained, but greatly increased. The best time to select the seed is just at maturity and from the standing crop. If selected from the crib, only the size and shape of the ears can be considered, and there is then no way of telling whether the best looking ears have come from prolific plants or not, or whether they owe their superiority to hereditary characters or to better conditions of soil and moisture. The kind of plant from which seed should be taken is one that, without any apparent reason, produces much better than plants surrounding it. To obtain uniformity of ripening, ears should be selected from plants that mature at approximately the same time. The plants should be of medium height, strong, well rooted, and with ears about 4 feet from the ground. The ideal ear is cylindrical in shape, or tapering only slightly from butt to tip, well covered at butt and tip, and with a high percentage of grain to ear. The grains should be closely set, deep, and well developed.

Care of Seed.

Immediately after gathering the seed, the ears should be placed to dry in a position where they will not touch each other, and where there is a good circulation of air. A simple method of drying is to hang the ears in strings of ten to twelve by looping binder-twine around one ear above another. When quite dry, the ears should be taken down and stored where neither moisture nor mice can injure them. If weevils are noticed in the seed, fumigation with carbon bisulphide must be resorted to. This is best done by placing the seed in an airtight box with a small dish of carbon bisulphide, and leaving for two or three days. After fumigation, the ears should be thoroughly aired.

Testing the Seed.

The next step in the selection of seed is to eliminate all ears that do not give a satisfactory germination test. The test is carried out in the following manner:—Fill a box to within an inch of the top with wet sand or sawdust, and spread over this a piece of cloth marked off into 1½-inch squares. A few grains from different parts of each of the seed ears are placed in each square in a definite order, so that it is afterwards possible to identify the ear from which particular grains have been taken. Then cover the grains with a damp cloth, and keep the box in a warm place until germination takes place. On examination, it may then be found that some of the grains have not germinated at all, while others have produced weak, sickly-looking sprouts. The ears from which such grains have been taken should then be discarded.

Grading the Seed.

In order to secure a uniform stand where the seed is sown by a maize planter, it is necessary to have the grains of uniform size. This is best accomplished by shelling the seed ears by hand—the tips and butts being first cut off and discarded. The remainder of the seed can then be separated into three approximate grades—large, medium, and small. When sowing, the planter may then be adjusted to sow the same number of grains of either grade, and a more even stand will be obtained.

TOBACCO FOR VICTORIANS.

By Max Valentine, Field Officer.

In discussing the various operations involved in the raising of tobacco, it must be remembered that there is a large number of distinct types of marketable tobaccoes produced, and the methods of planting, cultivating, harvesting and curing these varying types often radically differ.

Generally speaking, tobacco is classed under one of four main headings—cigar leaf (fillers and wrappers), cigarette leaf, pipe leaf and chewing tobacco. Each of these classes is grown under special conditions and in different localities. Tobacco of a kind will grow almost anywhere, but close attention must be paid to the position (distance from the Equator), climate and soil of a district before it can be decided which class presents the most likelihood of being a commercial success there. Thus we find that the planters in each tobacco-growing country engage in the raising of one type of leaf alone.

The islands of Cuba (Havana), Sumatra, Java, Borneo, and Manilla, and the State of Florida (U.S.A.) are the foremost producers of cigar leaf. A glance at the geographical positions of these places indicates that cigar leaf requires a sub-tropical climate with a very humid atmosphere and a hot but rainy summer. Therefore parts of Queensland have proved the most adaptable districts in Australia for this type. A quantity of cigar wrappers is also grown in Wisconsin and Connecticut, U.S.A., but artificial means of regulating the temperature in the fields have to be used.

The foremost cigarette leaf area covers what is known as the "New Belt" in the States of North and South Carolina, U.S.A., and lies between the latitudes 34 and 36 north. The climate there is temperate and the rainfall moderate. With this variety especially, the nature of the soil plays a big part. In the "New Belt" the best results are obtained where the ground is well drained and has a big depth of light sand, which for general farming would be considered very poor.

The world looks to the States of Southern Virginia and North Carolina, U.S.A.—latitude 36 north (usually spoken of as the "Old Belt")—for its main supply of pipe tobacco—commercially known as "Virginian" tobacco or "Bright flue-cured" tobacco from the fact that it is cured by artificial heat while hanging in a specially constructed barn or kiln, a process which gives it a bright, lemon-yellow colour. The soil in the Old Belt is slightly heavier and richer than that of the New Belt, and while the top soil is of a light sandy nature, the sub-soil consists of a yellowish clay. The summer climate is temperate, the winter rather cold, and the rainfall is moderate. The chief advantage of the climate, however, is the humidity of the summer nights which gives the leaf the texture and quality for which Virginian tobacco is famous.

In latter years other countries have successfully grown bright flue-cured tobacco. Both Canada and South Africa now produce a large percentage of their locally consumed tobacco. In Canada, in the neighbourhood of Lake Erie (State of Ontario), as the summer season is very short, the young seedlings have to be raised in hothouses in order that transplanting may take place early enough to give the crop time to mature before the autumn frosts set in. This handicap incurs an expense of two and a-half dollars (normally 10s. 6d.) per 1,000 plants. The long summer which we enjoy in Victoria eliminates the necessity for glass-houses.

The fourth class, chewing tobacco, also claims its own particular districts. The habit of using tobacco in this way is almost unknown in

Australia. The States of Tennessee, Ohio and Kentucky, U.S.A., easily supply the world's market. The climate in these districts is somewhat similar to that of the Old Belt, but the soil is heavier and richer. The variety for chewing, usually "Burley," is specially grown and cured so as to produce a leaf of a nature which can readily absorb a great quantity of various adulterants or sauces, required to make the "chew" flavorous.

These four major classes each consists of many minor varieties. Thus we have "Hester," "Warne," "Adcock," "Spotted Gum," &c., under the Bright pipe and cigarette type. Each one has its peculiarities, and it is only by experimenting that the grower can ascertain which will be most suitable for his particular field.

Figures supplied by the Government Statist from time to time reveal that Australian smokers are rapidly acquiring a taste for cigarettes and light pipe mixtures, while the demand for the heavier types of plug tobacco is rapidly diminishing. This means that a great market is available for flue-cured Virginian leaf. At the present time only 12 per cent. of the tobacco manufactured in Australia is locally grown. There is no reason why this percentage should not be very much greater.

Parts of Victoria have now been proved beyond doubt to be highly adaptable to this crop (Bright tobacco) both as regards climate and soil. Manufacturers are eager to obtain regular supplies of local flue-cured tobacco, and the existing Tariff on imported leaf of 2s. per lb. affords a suitable protection to local growers. Samples of Victorian tobacco which have been sent to English dealers for criticism have been reported on most favorably; in fact, they have offered to purchase supplies at a figure higher than is being offered to American growers for the same grade of leaf. Usually the reputation of the district whence a tobacco comes influences prospective purchasers to a great extent, and the fact that English buyers are prepared to lay aside the natural prejudice against a new variety shows an appreciation of the high quality of the Victorian article.

The opinion is being expressed that the growing of "Bright" tobacco will shortly represent one of Victoria's most flourishing industries. There is every justification for such optimism. Already several enterprising farmers have been rewarded by handsome returns of £75 to £150 per acre from their tobacco plantations. The industry should, therefore, become a source of wealth and prosperity to our community, and deserves every encouragement. At the same time, the industry has opened up a vast scope for scientific research, both in the selection of localities and in the cultivation and treatment of the crop. Local growers must become familiar with the most modern methods if they aspire to produce tobacco as good as the imported article, and should avail themselves of the experience of those in America and other countries who for decades have endeavoured to satisfy the fastidious tastes of the modern smoker.

[Articles descriptive of the latest methods of handling "Bright" tobacco will be published from time to time.]

Australia. The States of Tennessee, Ohio and Kentucky, U.S.A., easily supply the world's market. The climate in these districts is somewhat similar to that of the Old Belt, but the soil is heavier and richer. The variety for chewing, usually "Burley," is specially grown and cured so as to produce a leaf of a nature which can readily absorb a great quantity of various adulterants or sauces, required to make the "chew" flavorous.

These four major classes each consists of many minor varieties. Thus we have "Hester," "Warne," "Adcock," "Spotted Gum," &c., under the Bright pipe and cigarette type. Each one has its peculiarities, and it is only by experimenting that the grower can ascertain which will be most suitable for his particular field.

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HOME-MADE JAMS AND CONSERVES.

By Miss A. Knight, Fruit Preserving Expert.

The value of an assortment of home-made conserves, marmalades, jams, jellies, fruit butters, fruit puree, fruit pulps, &c., &c., is appreciated by most housewives. A variety of such may be conserved in the home by one method or another at a moderate cost. Fruits should be selected when each variety is most plentiful. They should be graded according to stage of ripeness, &c., and treated according to the method desired.

Pulped Fruit.

Pulped fruit is both economical and useful, and requires no great outlay for utensils, &c., while it is also a quick method of preservation, and its uses are many.

Pulp may be put up in large or small containers, according to convenience.

The essential points to be observed with this particular method of treating fruit are thorough sterilization, and sealing quite airtight whilst at boiling heat. The preparation of fruit and method are as follows:—

Preparation—

Apples.—Peel and core, and cut in two, or four, as desired.
Peaches.—Peeled and pitted.
Apricots.—All or some of stones removed.
Plums.—Some or none of stones removed (as desired).
Pears.—Peeled, cored, and quartered.
Tomatoes.—Washed and slightly crushed.
Berry Fruits.—Washed and drained quickly (without loss of colour in washing water).
Quinces.—Peeled, cored, and cut.

Method.—Place the desired amount of fruit in a preserving pan, with as little water as is necessary to commence the cooking and prevent burning.

Soft fruits, such as raspberries, loganberries, currants, tomatoes, &c., may be slightly crushed to draw sufficient of their own juice for cooking. When once the bulk is heated, the juice of these fruits is sufficiently free to continue the cooking. The mass should be kept stirred from the bottom of the pan until boiling temperature is reached. Retain that heat until the fruit is cooked throughout; softer fruits about 5 minutes; harder varieties about 10 to 12 minutes. Fruits such as apples, quinces, &c., which are of a drier nature when raw, should have a little water put in the pan with the prepared fruit to prevent scorching; the bulk should be brought slowly to boiling heat, and an even temperature right through the mass is essential.

The boiling pulp should, without delay, be poured into suitable airtight containers, and sealed whilst still at boiling point.

The pulp, if properly done, will keep indefinitely, and requires no sugar, salt, or preservatives.

Where a quantity of fruit is available, the pulp may be put up in petrol tins and sealed whilst at boiling heat. These tins would hold sufficient quantities for making up into jam at any later period, and

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would then be re-cooked and treated in exactly the same manner as if making jam from the fresh fruit, by adding the desired amount of sugar and finishing off as is usual for jam.

Fruit pulps may be economically stored in small jars (which must be airtight), and used at any time for pies, roll puddings, &c., and would require to be sweetened to taste when being used.

Large quantities of tomatoes may be kept in a good condition by this method, and later on converted into tomato sauce or chutney by re-cooking with the necessary flavouring agents.

The tomato pulp, if put up in small containers, will also be found most useful for soup, when it may be combined with meat-stock or milk, as is usual for tomato soup. This will be found to be very accept-

Various Ways of Cutting Fruit for Marmalade.

able at any time during all weather when fresh tomatoes are out of season and soup is in demand.

Tomato pulp is also much appreciated if re-heated with a little butter, pepper, salt, and served with grilled chops, sausages, &c.

Apple and tomato pulp form the foundation of many nice chutneys. They may be made up in winter or at any time convenient, by the addition of the required flavouring agents, vinegar, &c.

Jams.

All jams may be made either from fresh fruit or from pulp. Berry fruits, such as raspberry, loganberry, &c., &c., require a rapid boiling in order to secure a good flavour and to obtain a bright colour. Jams from apricots, plums, &c., also are better for quick boiling and bottling; other fruits, such as quince, pear, apple, &c., require a more gentle

cooking, so as to allow the conserve to gain the rich red colour which is natural to it.

Method of Treating Various Fruits for Jam Making.

RASPBERRIES, LOGANBERRIES, ETC.

Raspberry Jam.—The berries should not be over-ripe and fermenting. If selected at the right stage, the best result will be gained by bringing the mass to boiling heat without adding any water, stirring from the bottom of the preserving pan to prevent scorching. When boiling temperature is reached throughout the mixture, add the sugar—pound for pound of the fruit; stir well, so as to dissolve the sugar before the mixture reaches boiling heat again, then boil very rapidly for 8 minutes, when the jam should be of a good colour and consistency. Pour off into the prepared receivers, which should have been previously scalded, and thoroughly drained by standing upside down on a thick folded damp cloth; allow the jam to set, and then cover the surface with a thin coat of paraffin or other desired method of sealing.

Should the berries be more watery or riper than is desired, the boiling should be continued for a few moments before adding the sugar.

If the amount of sugar allowed is less than the weight of fruit, a longer boiling is advised.

The *Raspberry and Loganberry* makes a good jam if blended in equal quantities or in any desired proportion. For a mixture of these two fruits, from 10 to 15 minutes may be allowed at boiling heat before adding the sugar, and 5 to 8 minutes at boiling temperature after sugar is dissolved. The cooking should be done rapidly, and, as in the case of jam from either raspberries or loganberries, if less than an equal amount of sugar to that of fruit is used, give a longer boiling.

Loganberry jam may be made as described for raspberry and loganberry, and if one-third of the berries selected are used before they are fully ripe, a better consistency and colour is gained. Another mixture which makes an agreeable blend is as follows:—

Loganberry and Green Gooseberry Conserve—

Green gooseberries—6 lbs.
Firm red loganberries—6 lbs.
Water—2 quarts.
Sugar—10 to 12 lbs., as may be desired.

Method.—Boil the gooseberries gently in the water for about 30 to 35 minutes, or until a slightly pink tint is noticeable, then add the loganberries and cook at boiling heat for another 5 minutes, then add the sugar, and when dissolved, boil the mixture rapidly until the product is of a rich, clear red colour; when tested on a cold plate it should readily respond to the usual test for jelly. When this stage is reached, allow to cool down a few degrees before conveying it into the sterilized containers.

Loganberry and Cherry Plum is another blend which gives a nice result—

Loganberries (firm red)—3 lbs.
Cherry plums—3 lbs.
Sugar—4½ lbs.

Put the plums on to cook with about one cupful of water, and when they are cooked fairly soft add the loganberries, and boil for another 10

minutes; then add sugar and bring to boiling heat after sugar is dissolved, then boil fast until of a good consistency.

Plums.

There are quite a variety of plums from which to make a selection for jam: purple, red, and light. The Orleans and the Blue Diamond both give a nice colour and good-flavoured product. The light plums are favoured by some, and of these also several varieties are suitable. Greengages give a better result if the fruit is not over-ripe.

With most varieties, if portion of the fruit selected is slightly under-ripe the finished product has a more jelly-like consistency and a better appearance.

It is not always advisable to sprinkle the sugar over plums overnight before cooking (unless they are peeled, and this is not usual), as the sugar sometimes causes the skins to become tough.

The average amount of sugar for most plums is from ¾ lb. to 1 lb. for each lb. of fruit, though some prefer only ½ lb. for each lb. of greengages. Where so small an amount of sugar is used the boiling should be continued for a longer period. The product in such cases does not look as attractive, nor is its keeping quality as reliable as when the larger quantity of sugar is used.

Plums are usually put on to cook in a little water, or weak syrup if preferred. The mass should be brought to boiling point rapidly so as to retain the brightness of colour, and it should be kept at boiling point for 30 minutes or so, according to the variety of plums. Then add the sugar and bring the whole to boiling heat again, finishing the cooking rapidly, testing occasionally until it drops heavily from the stirring rod. The mass should gelatinize on cooling.

The following blends make a change, and give good results:—

Blue diamond plum and mulberry.
Cherry plum and gooseberry.
Light plum and peach.
Light plum and pineapple.
Damson and apple juice.

The apple juice required for the last-mentioned blend may be obtained by boiling small apples and parings, and straining as for jelly.

Fig Jam and Conserve.

For jam and conserve many prefer to skin the figs. This may be done by scalding them for a few minutes in boiling water, and then wiping; any hard little stem should be cut off.

The following method gives a nice rich conserve::—

6 lbs. firm figs.
1 pint vinegar.
1 pint water.
6 lbs. sugar.

Method.—Stem or skin fruit as may be desired: Make a syrup by boiling the vinegar, water, and sugar together for 8 or 10 minutes, then put in the prepared figs (whole) and simmer slowly for 4 hours. The fruit remains whole, and when finished the product should be of a clear, reddish-brown colour, and have a nice flavour.

For fig jam the following are required:—

8 lbs. figs.
6 lbs. sugar.
4 ozs. green ginger (suspended in a muslin bag).
1 quart water.

Method.—Prepare the figs by skinning and cutting into large pieces; make a syrup of the water and sugar, and boil for a few moments, with ginger suspended in bag, then drop in the prepared figs and bring to boiling heat for 5 minutes or so, and allow to stand overnight. Next day boil gently until the fruit is transparent and clear, and should there be more syrup than fruit, strain off the syrup and boil it rapidly for a few moments so as to reduce the quantity, then pour over the figs, and heat up altogether and convey it to the containers.

Cape Gooseberry Conserve.

6 lbs. cape gooseberries.
1 quart water.
5 lbs. sugar.

Method.—Make a syrup of the sugar and water by boiling it for 10 minutes; then add the fruit, and cook until of a clear amber colour and good consistency.

Peach and Pineapple Chips.

6 lbs. prepared peaches.
2 lbs. pineapple.
6 lbs. sugar.

Skin and stone the peaches and cut into chips, not too large. Skin the pineapple, being careful to remove the eyes and core, then cut it into fine chips. Strew portion of the sugar over the prepared peaches for some hours, or overnight; add pineapple and bring slowly to boiling heat, and retain that heat until the fruit is cooked, then add the balance of the sugar, and when dissolved the mixture should be given a good sharp boiling until of the desired consistency.

Apricot Conserve.

12 lbs. apricots.
1 quart water.
12 lbs. sugar.

Select deep-coloured apricots and remove stones; make a syrup of portion of the sugar and the water, and boil for a few moments; then add the prepared fruit, and bring to boiling temperature, and retain that heat for from 15 to 20 minutes, and add the remainder of sugar when boiling heat is again reached. When the conserve is of a good consistency (say 10 minutes or so) convey the mixture into the prepared containers, and seal when set.

If liked, a few blanched kernels may be added to the mixture a short time before finishing off.

Gooseberry Jam and Conserve.

Conserve—

8 lbs. green gooseberries.
4 quarts water.

Boil the berries gently in the water until a slightly pink tint is visible, then measure the whole in a jug or cup, and allow an equal measure of sugar to the bulk, dissolve the sugar, and bring to boiling heat again; then cook rapidly until the mixture jellies when tested. This is a nice jellied product of a rich, clear, red colour.

Jam.—If a thick jam is desired allow less water, and an equal weight of sugar, or three-quarters that amount if preferred.

Melon Jam and Conserve.

Jam.—The melon is pared, seeded, and cut into any sized pieces desired. The prepared melon may be steeped in just sufficient water to cover it for 48 hours or so, then brought to boiling heat, cooked gently until tender and clear. There are various flavourings that may be used. Lemon juice is usually added; and, in addition to this, pineapple, or ginger, or other flavouring material is an improvement. Some prefer the lemon or orange skins in addition to the juice; but when these are added they should be very finely cut, so as to become quite clear in the finished product. When the melon has become cooked as above described, add three-quarters the weight of sugar to that of fruit used, and finish the boiling rapidly after dissolving the sugar. The product should have a golden appearance, and be of a good consistency.

Conserve.—Select a melon, weighing about 12 lbs., not too ripe, and cut it into medium-sized blocks, remove seeds. Put the prepared melon into an enamel pan or other suitable bowl, and just cover it with water, in which two level teaspoons of powdered alum has been dissolved, and allow it to remain overnight or two nights. Then place it on the stove, previously placing in mixture ¼ lb. green ginger in muslin bag; cook gently till tender. Afterwards strain through a sieve placed over a basin, so as to save the water in which the melon has been boiled, but do not break the melon unnecessarily. Meanwhile, in the preserving pan, make a syrup of—

1 pint of the melon water.
Juice (strained) of 6 or 7 lemons.
7½ lbs. sugar, and if liked a trace of cayenne pepper.

Boil this syrup for 10 minutes, then add the melon and ginger, and allow it to cook in this until of a perfectly clear, transparent nature, when the conserve will be ready to be packed into the receivers with the thick syrup; when cold, set and seal.

The melon water which has been strained from the cooked melon should now be treated for jelly. To each 1 pint of melon water allow the juice of 1 lemon; bring to boiling heat for a few moments; strain through a jelly bag, then measure the juice and return it to the clean preserving pan. Add an equal measure of sugar to that of liquid, and finish with a rapid boiling until it jellies when tested in the usual way.

This results in a nice, clear, firm jelly, while the conserve is equally as good.

Black Currant Conserve.

When black currants are obtainable in a good firm condition, they make a nice product if treated in the following manner:—

For each 1 lb. of firm berries allow 1 pint of water. The fruit should be cooked in the water at boiling heat for about 20 minutes or

so. The bulk then measured, as with jelly, and about 14 or 15 ozs. of sugar allowed to each pint of fruit and juice. Add the sugar, and bring gradually to boiling heat, then boil the mixture fast for a short time until the juice will respond to the test for jelly.

If the fruit has become fully ripe very much less water should be added (about 1 pint to 4 lbs. fruit). Cook to a pulp, and then add sugar in the proportion of 12 to 14 ozs. to each lb. of fruit used; then re-boil rapidly until of the right consistency.

The Apple.

The peels, cores, and windfalls may be treated in the following manner, and kept in reserve for using with fruits such as strawberry, blackberry, and others.

Method.—Take a fair quantity of windfalls, cores, and skins of any or several varieties of apple. Put these into a preserving pan, cover them with water, bring to simmering heat, and allow them to cook slowly for a fair time, so as to extract the goodness from the fruit; then strain through a large sieve; afterwards run the liquid through a muslin, and then bring it to boiling heat, and hermetically seal in suitable containers whilst at that heat. It may then be stored for future use, and will be found most useful for improving other fruits, such as strawberries, &c. There is no pronounced flavour in the apple, yet it is one of the most valuable fruits we have in assisting others.

Blackberry and Apple.

6 lbs. blackberries (firm).
2 quarts apple water.

Boil together for about 20 minutes, then add $\frac{3}{4}$ lb. of sugar for each lb. of fruit, and afterwards finish the cooking rapidly, until the jellying stage is reached.

Strawberry Conserve.

6 lbs. strawberries (firm).
2 pints red currant juice.
6 lbs. sugar.

Cover the strawberries overnight with half their weight of sugar; then cook them, for about 20 minutes or so, in the juice, which the sugar has extracted; then add the red currant juice, and allow to boil up again for a few moments; add the remaining portion of the sugar, and when dissolved finish the cooking rapidly.

Another nice conserve can be made from the following:—

2 lbs. strawberries.
1 pint apple water.
$2\frac{1}{2}$ lbs. sugar.

The method is the same as that described for the other strawberry conserve.

Orange Marmalade.

The "Seville" and the "Poorman" oranges are the most generally liked for marmalade, though other varieties may be used for the purpose. Either of the above named gives a clearer product, and also a bigger yield than the sweet varieties.

Different Varieties of Citrus Fruit for Marmalade.

Method of making marmalade from the "Seville" orange.—Select clean skinned fruit, and after wiping thoroughly weigh them, and allow about 1 quart of water to each 1 lb. of fruit used.

Preparation of the Fruit.—Finely shredded skins make the most attractive product. This is a slow process when done by hand, and patience is necessary if any quantity is being treated. There are, however, small revolving cutters obtainable and these serve the purpose very well, providing the blades are kept wiped to prevent any discoloration. Where no cutter is at hand, and economy of time is to be considered, a very fair product may be obtained by passing the skins (after removing juice and pulp) through a food mincer. In the latter way, of course, the fruit would not have a sliced appearance, but a uniform cut would be obtained. If the cutting is to be done by hand, the main thing is to have a well-sharpened knife, and a clean kitchen board to cut up on. It is better to carefully remove the juice and pulp of the orange before commencing to cut the skins; this makes the work easier. Place juice in a basin; after the preparation of skins they may be put into another basin or convenient receptacle; cover them with the water in which they are to be cooked, and allow to remain overnight. The centre rag or core of the orange, also pips, should be removed from the flesh of the fruit and soaked overnight in a little of the water; next morning strain the water from them into the bowl containing the peel to which the juice and flesh of the orange is also added.

How to Cook the Marmalade.—It is then put to cook in a suitable preserving pan which should be large enough to allow not only room enough for the sugar, which is to be added later on, but also sufficient room for the mixture to boil without overflowing. A gentle cooking should be given until the skins have a semi-transparent appearance, the length of time depending mainly upon the method and thickness to which the skins have been cut, the finely cut skins being cooked sooner than those which are more thickly cut, and the minced peel will require a longer time than the finely shredded. When this stage is reached the bulk is measured with a jug or dipper or cup, according to quantity and convenience, and an equal amount of sugar is allowed. Dissolve this gradually during the time the mixture is coming to boiling point, and boil rapidly until the product is of quite a clear amber colour and of the consistency required for jelly. Having reached this stage the marmalade should be removed from the fire, and

The Raw Material and the Finished Product.

allowed to cool slightly (but not too much) and poured into containers, which have been scalded and drained on a damp folded cloth. If glass containers are used, stand them, after filling, on a folded damp cloth until cool. Cover the top with paraffin after the marmalade has set and is cold, when they will be ready to store.

The "Poorman Orange" will give a good yield of marmalade; the method of making it is exactly the same as that laid down for treating the "Seville."

If a thick concentrated marmalade be required, use about 1 pint of water only to each 1 lb. orange, and cook in the same way. For sweet orange marmalade 1 pint of water and the strained juice of 1 lemon should be allowed for each 1 lb. of fruit used. The method of cooking is the same as in the case of Seville oranges.

The citron also makes a nice clear marmalade of a delicate tint, and good flavour and consistency; the preparation is the same as for Seville marmalade, and usually the product is improved by the addition of the strained juice of one lemon to each citron.

Fruit Butters.

There are several varieties of these conserves; some are highly flavoured and sweetened, while others have the addition of eggs and butter.

Apple Butter.

The peeled and cored fruit is cooked slowly for a long time in cider, or else in apple water as before described. It is not necessary to add sugar, as when concentrated by a long slow cooking the product is usually sufficiently sweet. Any flavouring agent as cinnamon, ginger, cloves, or other similar ingredient is usually added, and its appearance when finished should resemble a smooth thick paste, brown in colour. It is then stored in small pots for future use.

Plum Butter.

Either fresh or pulped fruit may be used, the excess of water is driven off by boiling, and the material is then passed through a sieve and afterwards returned to the pan with half its weight of sugar. If desired a little vinegar may be added and the product mildly spiced with pimento or other desired spices. The cooking is continued until the mixture is of a thick consistency, when it is ready for storing away in small pots.

Lemon Butter.

2 oz. butter,
3 eggs,
1 lb. sugar,
½ pint lemon juice (strained),
½ pint water.
If liked, add one or two drops of oil of lemon, or if preferred, grate the rind of one or two lemons.

Method.—Melt butter in preserving pan, add sugar and stir well; add the eggs well beaten, then the lemon juice and water; keep the mixture stirred as it boils, and allow to cook for about 15 minutes or so, when it should be of a nice consistency and colour.

Another method:—

7 oz. butter,
2¼ lbs. sugar,
9 eggs,
18 oz. maize syrup—dissolved in 1 pint of water,
½ oz. citric acid,
7 oz. lemon } mixed together,
7 oz. water }
Few drops oil of lemon.

Melt butter in preserving pan, add sugar and stir well; add eggs, well beaten; then lemon and water; then maize syrup, dissolved in water; then citric acid. Keep the mixture constantly stirred, and retain at boiling heat for about 15 minutes; add oil of lemon when the boiling is finished.

Passion Fruit Butter.

2 oz. butter,
3 eggs,
1 lb. sugar,
Pulp of 8 passion fruit,
4 tablespoonsful of lemon juice,
4 tablespoonsful of water.

Method.—Melt butter and add sugar, then eggs, well beaten; mix the passion fruit, lemon juice and water together, and strain and add to the mixture; cooking as with lemon butter.

Covering Jams with Paraffin.

Covering the Surface of Jams with Paraffin Wax.

This is a clean white wax, and is very suitable for covering the surface of the finished product. The wax may be readily melted in a pannikin or clean tin, kept for the purpose, by placing it in a pan of boiling water, and allowing it to remain there for a few moments until the wax is in a liquid form. If the tin, containing the paraffin, has a lip formed by pressing the sides together at the top, there will be no difficulty in pouring the melted wax evenly over the surface of the product, which has cooled and set. Just a very thin layer is necessary, and this should adhere to the inside margin or rim of the container.

BUSH-FIRE BRIGADES.

By A. J. Gill, Dairy Supervisor.

There is possibly no calamity which can inflict such great loss to a land-holder in a short space of time as a bush-fire. The comfortable house and pleasant garden, well-grassed paddocks and trim fences of the morning are, before nightfall, turned to blackened ground, with a few half-burnt posts and logs, and perhaps nothing more than charred trees and smoking heaps to mark the site of the homestead.

Yet, with this continual danger hanging over them during the summer months, it is astonishing to find how little preparation is made by those living in bush country to combat this merciless enemy. It is not uncommon to see long dry grass within a few feet of a dwelling and haystack, without even a narrow ploughed break for protection. In fact, it is unusual to see a place where any attempt has been made to render either homestead, buildings, or haystacks safe from fire.

The necessity of being ready to combat fires cannot be too strongly urged on farmers and graziers. Undoubtedly the best preparation would be the formation of bush-fire brigades. In very many cases, a body of 20 to 40 men, armed with fire-fighting appliances, and working methodically under experienced leaders, would make the spread of a fire almost impossible, and thousands of pounds worth of property and stock would be saved annually. A fire once beaten down could be kept under control and watched till quite safe. Two of the most disastrous fires I have known burnt only a few acres the first day. One of these spread over only about 20 acres one afternoon, but broke out the following day and swept over an area of 100 square miles. The second fire burnt about 5 acres the first day; but, breaking out afresh the following morning, continued for several days, and devastated an area of approximately 400 square miles. In both cases, no one bothered to watch the fire, or even visit the outbreak the following morning, to see if there were any danger; whereas, under organized management, this would have been one of the things first attended to.

Again, want of organization is often the cause of a fire spreading. When an outbreak occurs, helpers usually turn out willingly enough, but only when they get to the fire do they think about looking for bags or bushes with which to beat the flames. Further, there is no concerted action; while some are beating the fire, others are running ahead setting trails going, possibly doing more harm than good. In a properly organized brigade, each man would be equipped with a fire-beater, and all would work in unison. Water-carts would also be available so that burning timber could be quenched and the grass damped where necessary.

The majority of land-holders are fully aware of the necessity for bush-fire brigades, but each waits for some one else to take the lead and call the necessary first meeting. But, if once this step were taken, the formation of a brigade would quickly follow. Shire councils might well give attention to the establishment of such organizations.

Each shire might well be divided into districts for the purpose of fire-control, taking as boundaries, main roads, rivers, and tops of ranges.

Where country is cut up into ordinary farm holdings on hilly country, 7 to 8 miles square will be found sufficient territory for one brigade to operate in, and 10 to 12 miles square on level country.

It would be necessary for each brigade to have three or four water tanks, each holding 150 gallons, mounted on cart or on sledge according to the nature of the country, and equipped with force pumps and hose. Each cart should also carry three or four sharp axes. The tanks might be stationed at the most convenient farms, and should, of course, be kept filled during the summer months. A harnessed horse should also be kept in readiness between the hours of 10 a.m. and 4.30 p.m. on each threatening day throughout the summer. Every member of a brigade should keep a fire-beater and water-bag.

There are two kinds of beaters in use—the tanned sheepskin and the solid strip of sole leather—either of which is fastened to a handle, from 5 to 6 feet long. Of the two, I prefer the strip of sole leather, say, 23 inches by 12 inches, fixed to the handle by two small bolts. It is light, effective, and wears a long time.

A captain, as well as foremen, should be appointed, the latter having a definite rating in order that they may take control in the absence of the captain. In order to purchase the equipment for a brigade it would be necessary for the land-holders in the district to contribute according to the value of their holdings. The best method to adopt, in order to arrive at the amount each farmer or grazier should pay into the necessary fund, would be for each to give in proportion to the annual rateable value of his property. For instance, if a levy of a penny in the pound were agreed upon, the annual contribution on account of a holding valued at £60 per annum would be five shillings. Probably insurance companies would also be willing to give the movement substantial assistance.

Besides being ready to fight bush-fires the brigade could help to lessen the chances of any serious fire by burning breaks at dangerous points, such as where a railway track runs close to a heavily-grassed paddock, round spots frequented by campers, &c. Breaks could also be burnt around any homestead by the brigade if an owner so desired. This would give some protection against fire while a farmer was absent from his home helping the brigade to combat an outbreak of fire. A very effective break against fire can be provided by the choice of land for a summer crop. A maize or potato crop situated on the more dangerous side of a stack or dwelling makes a splendid fire check.

STALLION REGISTER, 1921-22,

under the "Horse Breeding Act 1919."

Part II.—Registrations after 17th August, 1921, and prior to 16th September, 1921.*

Cert. No.	Name.	Age.	Class.	Owner.	Address.
		Yrs.			
697	Abbot's Best ..	A	Draught ..	J. Egan ..	Barwite
707	Abbotsford ..	A.	,, ..	McGregor Bros.	Rochester
894	,, II. ..	3	,, ..	D. H. Adams ..	Elmore
753	Abbot's Pride ..	A	,, ..	W. H. Gadd ..	The Glen
708	Aberdeen	A	Thoroughbred	C. T. Lucas ..	Pomborneit
919	,, ...	A	Light ..	J. Troup ..	Coghill's Creek
597	Adventure ..	4	Pony ..	C. H. Waters ..	Corryong
709	Agitation II. ..	2	Draught ..	R. Tyack ..	Benalla
710	Albion	A	,, ..	J. Oakes ..	Nathalia
920	Almont of Rythdale	A	Light ..	E. Wright and Son	Pakenham East
895	Altona	5	,, ..	A. G. Hunter ..	Elmore
983	Amberstain ..	A	,, ..	J. L. Cummings	Berrinal
634	Axedale Prince ..	5	Draught ..	J. G. Bunworth ..	Donald
711	Bally Leigh ..	A	Pony ..	J. T. Carroll ..	Molka
984	Bang Wong ..	4	Light ..	C. M. Marchant	South Lillimur
712	Barnone	A	Draught ..	G. A. Dunnet ..	Stockyard Hill
604	Baron	3	,, ..	W. Maguire ..	Myrtleford
909	,, Allie ..	3	,, ..	H. Jackman ..	Tandarra
921	,, Bill ..	4	,, ..	P. H. Muller ..	Dimboola
965	,, Brae ..	5	,, ..	S. H. Wilson ..	Katamatite
635	,, Clydesdale ..	3	,, ..	W. H. Penno ..	Boort
713	,, Bombay ..	A	,, ..	Shiells Bros. ..	Youanmite
935	,, Duke ..	2	,, ..	A. Colvin ..	Nathalia
714	,, Leigh ..	A	,, ..	Meer Khan ..	Modewarre
715	,, McLeod ..	A	,, ..	R. Kerr ..	Yering
896	,, May ..	4	,, ..	A. G. Hunter ..	Elmore
780	Baron's Idol ..	A	,, ..	J. Carmichael ..	Burramine North
636	,, Premier ..	2	,, ..	J. Petrie ..	St. Arnaud North
897	,, Pride ..	3	,, ..	J. J. Quinn ..	Elmore
913	,, Style ..	3	,, ..	A. J. Browne ..	Werribee
986	,, ,, ..	3	,, ..	S. H. Wilson ..	Katamatite
605	,, Stanley ..	3	,, ..	W. H. Wright ..	St. Arnaud
724	,, Superior ..	6	,, ..	C. J. Walker ..	Trafalgar
705	Baron Wighton ..	A	,, ..	Department of Agriculture	Werribee
716	Beau Brummell ..	6	Light ..	J. Scott ..	Neilborough
914	Bell Boy Voyage ..	4	,, ..	S. J. McKay ..	Mitiamo
717	Bellmain	A	Draught ..	D. Lang ..	Tungamah
922	Belmont Again ..	4	,, ..	W. A. Creighton	Alexandra
501	Bill Yevnoe ..	4	Pony ..	S. Convey ..	South Melbourne
718	Billie	4	,, ..	F. T. Kemp ..	Ouyen
502	Billy Mac	A	Light ..	A. G. Wilson ..	Shepparton
606	Bismarck	A	,, ..	H. J. Manthorpe	Inglewood
719	Black Bolt ..	A	Pony ..	L. Brown ..	Horsham
720	,, Boy ..	A	Light ..	J. Killeen ..	Sale
723	,, Steel ..	A	Thoroughbred	J. K. Shepherd ..	Galah
722	Blue Ribbon ..	A	Draught ..	W. Walker ..	Manangatang

* For registrations prior to 17th August, 1921, see *Journal* for October, pp. 625-634.

STALLION REGISTER, 1921–22—*continued.*

Cert. No.	Name.	Age.	Class.	Owner.	Address.
		Yrs.			
725	Blue Wilkes ..	A	Light ..	J. W. McNeill ..	Weering
726	Bob Ash	A	,, ..	T. Moore ..	Kialla East
607	Bobbie	3	Pony ..	W. Northby ..	Gre Gre Village
900	Bob's Fancy ..	A	Light ..	T. Lee, jun. ..	Mulwala, N.S.W.
503	Bogandyera ..	A	,, ..	J. Hargreaves ..	Eskdale
716	Bold Donald ..	2	Draught ..	H. Jackman ..	Tandarra
982	,, Prince ..	3	,, ..	G. Ross ..	Mt. Prospect
727	,, Rowan ..	A	Light ..	J. W. McNeill ..	Weering
728	Bonnie Belmont ..	A	Draught ..	W. Williams ..	Corrin's L.B.
923	,, Brae ..	A	,, ..	King Bros. ..	Kinnabulla
638	,, Mac ..	5	Light ..	T. G. Charity ..	Serpentine
504	,, Voyage ..	A	,, ..	Busst and Glasheen	Huntly
507	Bon Wickliffe ..	A	,, ..	J. Ford ..	Wickliffe
987	Bonza Voyage ..	2	,, ..	R. Gray ..	Echuca
733	Boro Sportsman ..	A	Draught ..	E. W. Nolte ..	Merino
729	Bower Bank ..	A	Light ..	J. O'Bree ..	Piangil
508	Bramhope Monarch	A	Draught ..	G. Hicks ..	Miram
730	Breakfoot ..	A	Light ..	F. R. Anderson	Bundalong Sth.
509	Brecknock ..	A	Pony ..	R. Hentschell ..	Bonnie Doon
988	Brigham Again ..	4	,, ..	J. H. Hindhaugh	Weerite
510	,, ,, ..	A	,, ..	J. Burns ..	Euroa
989	,, Shanter ..	6	,, ..	J. J. Wall ..	Numurkah
990	Bristol	3	Draught	R. J. Jones ..	Bet Bet
731	Briton Again ..	A	,, ..	R. Trimble ..	Rutherglen
732	,, Pride ..	A	Pony ..	G. Kenworthy ..	Ballarat East
924	Brooklyn Junior ..	A	Light ..	J. W. Murchison	Dumbalbalane
623	Brydon	A	Draught ..	G. H. Whykes ..	Woodside
608	Bundoora Black Leigh	4	Light ..	Miss B. Bruce-Reid	Bundoora
511	Bute Laddie ..	A	Draught ..	Crawford Bros. ..	Tatura
512	Cacique	A	Thoroughbred	J. H. Templar ..	Nhill
513	Carmantine ..	A	Light ..	H. A. Austin ..	Elaine
766	Caledon	A	Thoroughbred	W. J. Keys ..	Pyramid Hill
735	Calland Dale ..	A	Draught ..	J. E. Hooper ..	Devenish
639	Canberra	A	,, ..	C. H. Bowland ..	Nandaly
734	Carman	A	Thoroughbred	J. W. Pendergast	Benambra
514	Cathedral Chimes ..	A	Light ..	A. B. Carter ..	Guildford
736	Cedric	A	Draught ..	T. Robertson ..	Macarthur
981	Celmar Style ..	4	Light ..	W. Cochrane and Sons	Ballarat
515	Child Abdallah ..	A	,, ..	R. Beyer ..	West Footscray
737	Circle Star ..	3	,, ..	T. A. Griffiths ..	Glenrowan
738	Claredon	A	Pony ..	Bennett Bros. ..	Coleraine
739	Clarendon II. ..	A	,, ..	C. Underwood ..	Newfield
516	Clarey	A	,, ..	J. Jones ..	Mywee
925	Clarion	A	,, ..	W. H. Thompson	Yalca
517	Clermont	A	Draught ..	J. C. Dufty ..	Lorquon West
640	Cleverland ..	A	Pony ..	W. McKenzie ..	Warracknabeal
518	Clyde Laddie ..	6	Draught ..	J. Alexander ..	Caniambo
519	Cobbler	4	,, ..	G. H. Hill ..	Horsham
740	Cock Robin ..	A	,, ..	A. D. Redenbach	Tambo Upper
520	,, ,, ..	A	,, ..	A. J. Jessep ..	Tinamba
699	Coliban	A	,, ..	W. Todd ..	Taradale
641	Colin More ..	3	,, ..	K. Cameron ..	Warracknabeal
521	Congress	A	Pony ..	J. Reid ..	Warrion

STALLION REGISTER, 1921–22—*continued.*

Cert No.	Name.	Age.	Class.	Owner.	Address.
		Yrs.			
522	Conqueror.. ..	2	Draught ..	M. McKinnon ..	Beasley's Bridge
523	Coolband	A	Light ..	M. F. O'Donnell	Cowangie
741	Cosmopolitan II. ..	A	,, ..	J. R. and A. Wade	Glen Alvie
742	Costrel	A	,, ..	C. Sutton ..	Fenton's Creek
757	Cremoran's Pride ..	A	Draught ..	W. S. Wall ..	Underbool
767	Cronje Wilks ..	A	Light ..	G. B. Mackie ..	Camperdown
926	Dalmore	A	Draught ..	C. S. B. McFarlane	Hopetoun
652	,, Pride ..	2	,, ..	Massa Singh ..	Pier Millan
991	Dan Again ..	A	,, ..	C. J. Dunster ..	Willaura
527	Dandenong ..	3	Pony ..	R. C. Ladlow ..	Dooen North
525	Dandy Again ..	A	,, ..	R. Lawler ..	Ouyen
743	,, Dick ..	A	,, ..	L. Bennett ..	Nullawil
992	,, Jim ..	A	,, ..	E. McDonald ..	Tangambalanga
526	,, Lad ..	A	,, ..	H. C. Head ..	Seymour
927	,, Nut ..	A	,, ..	E. E. Small ..	San Remo
528	,, Premier ..	3	Draught ..	W. Lucas ..	Kunat
993	,, Style ..	5	Pony ..	S. K. Lobb ..	Nagambie
744	Decorator ..	A	Light ..	F. E. Jennings ..	Inglewood
642	Deck Top ..	5	,, ..	Mackin Bros. ..	Korong Vale
610	Defender	4	Draught ..	E. G. Straube ..	Nyam
745	Demo Dick ..	A	Light ..	A. E. Nuske ..	Kewell
898	Denmark	A	Draught ..	D. L. Bodey ..	Jung
659	Derby Chimes ..	A	Light ..	H. Saunders ..	Wodonga
643	Direct Alto ..	4	,, ..	G. P. Howell ..	Inglewood
768	,, Harry ..	A	,, ..	J. Rousch ..	Cohuna
706	Director	A	Pony ..	J. J. Quinn ..	Elmore
994	Donald	A	,, ..	G. H. Whitehead	Minhamite
754	,, ...	A	Light ..	O. Bonney ..	Nyora
915	Don Alto	A	,, ..	G. Maxwell ..	Wangaratta
995	Donovar	3	,, ..	D. D. Morrison ..	Aringa
644	Dontourie ..	5	,, ..	W. McGowan ..	Sea Lake
996	Dorregal Chief ..	5	Draught ..	C. R. McCallum	Pepper's Plains
529	Drum Laddie ..	A	,, ..	H. E. Barker ..	Lancaster
746	Duddon	A	Thoroughbred	E. W. Dixon ..	Cowes
748	Duke Little Eyes ..	6	Draught ..	A. E. Bowman ..	Ebden
747	,, of Sandmount	3	,, ..	E. Bassett ..	Sandmount
530	Dundonald's Chief ..	A	,, ..	H. Doherty ..	St. James
531	Eastern Star ..	A	,, ..	D. and G. McDonald	Minyip
532	Eaton Headlight ..	3	,, ..	E. W. Schneider	Yulecart
533	Echelon	A	Light ..	H. T. Nicholas ..	Thornton
534	Emulator Junior ..	A	,, ..	W. H. Whitbourn	Clayton
755	Euphorion ..	A	Thoroughbred	P. Travis ..	Chiltern
804	Fairfield	A	Light ..	A. Lenon ..	Nyah
535	Falmouth ..	A	Thoroughbred	A. F. Cullen ..	Wahgunyah
749	Fashion Direct ..	A	Light ..	T. F. Hogan ..	Sandhill Lake
645	Fatty Arbuckle ..	5	Draught ..	J. R. Mills ..	Bangerang North
750	Federal Duke ..	A	,, ..	J. Hendry ..	Bridgewater-on-Loddon
536	,, Prince ..	A	,, ..	G. Luckie ..	Springhurst
758	,, ,, ..	A	,, ..	G. M. Vallence ..	Cohuna
928	Federation ..	A	Pony ..	A. Wilson, jun. ..	Cororooke
537	Federation's Pride ..	A	Draught ..	W. H. Major ..	Dooen North
698	Fidelio	A	Thoroughbred	J. Sweeney ..	Boolite
997	First Shot.. ..	3	Light ..	F. A. Rigby ..	Piavella

STALLION REGISTER, 1921-22—*continued.*

Cert. No.	Name.	Age.	Class.	Owner.	Address.
		Yrs.			
506	First Voyage ..	A	Light ..	Busst and Glasheen	Huntly
759	Fitzallan	A	Draught ..	S. P. Vaughan ..	Nyam
929	Flash Jack ..	A	Light ..	W. J. Campbell	Horsham
980	Flashwood ..	4	,, ..	R. Ellis ..	Korweingubora
760	Flying Star ..	A	,, ..	O. Martin ..	Leongatha
761	Foreigner	A	Pony ..	C. Ferrari ..	Devondale
612	Foreman	3	Draught ..	T. Thornton ..	Waaia
538	Fred	A	,, ..	A. Dunning ..	Numurkah
998	Freedom	A	Light ..	E. W. Roscoe ..	Nooramunga
762	Free Scot	A	,, ..	T. Robertson ..	Macarthur
788	Garfield Junior ..	A	Pony ..	T. Robertson ..	Macarthur
619	Gay Voyage ..	A	Light ..	P. H. Beaumont	Ouyen
979	General Dale ..	2	Draught ..	J. Jolliffe ..	Newlyn
789	,, Harvey ..	A	,, ..	Koschitzke Bros.	Bangerang
790	,, McDonald	A	,, ..	W. Pacholli ..	Mysia
791	,, Scotch ..	4	,, ..	D. L. Bodey ..	Jung
792	Ginger	A	Light ..	D. McLean ..	Chiltern
793	Gisborne	A	Draught ..	E. Scott ..	Day Trap North
930	Glad Bells ..	A	Light ..	D. McLeod ..	Kyabram
794	Gladiator	A	Draught ..	H. Jeitz ..	Rainbow
646	Glen Arthur ..	4	,, ..	C. T. Henderson	Weatherboard
598	Glendale	4	,, ..	A. J. McDougall	Katandra
613	,, ...	3	,, ..	W. Walker ..	Euroa
539	Glenfallock ..	A	,, ..	A. H. Johnston	Walpa
795	Glenlea	A	,, ..	A. F. Smith ..	Nypo
542	Glenmore	A	Light ..	J. F. Prankerd ..	Gillingall
899	Glenscott	5	Draught ..	P. McNeill ..	Kyneton
599	Gnarpost	5	Light ..	P. B. O'Keefe ..	Rutherglen
999	Gold Coin ..	A	Draught ..	A. E. Cummings	Berrimal
797	,, Dust ..	A	Light ..	W. E. Maybury ..	Nurcoung
796	Golden Action ..	6	,, ..	W. Watts ..	Kamarooka
1001	,, Voyage ..	4	,, ..	R. Johnson ..	Bendigo
543	Gold Tuck ..	A	,, ..	J. J. G. Barns ..	Euroa
1000	Goulburn Valley ..	5	,, ..	T. Moore ..	Kialla East
557	Grand March ..	A	Draught ..	W. M. Hughes ..	Inglewood
505	Gratton's Voyage ..	A	Light ..	Busst and Glasheen	Huntly
544	Guide's Wing ..	A	Pony ..	J. Lawless ..	Burramine South
764	Hames	A	Light ..	T. Dean ..	Cann River
932	Hampton Ben ..	A	Draught ..	Todd Bros. ..	Willenabrina
545	Happy Jack ..	A	Pony ..	J. B. Atchison ..	Southern Cross
798	Harmattan ..	A	Thoroughbred	C. P. Tobin ..	Eskdale
546	Harold A. ..	A	Light ..	R. M. Smith ..	Landsborough
785	Harry Almont ..	A	,, ..	S. Pemberton ..	Wedderburn
803	Harvest Again ..	A	,, ..	W. J. Clarke ..	Ouyen
547	Hayston	A	Thoroughbred	A. E. Barker ..	Lancaster
548	Heather King ..	A	Pony ..	W. M. Dwyer ..	Merino
799	Herd Lad ..	A	Draught ..	T. Williams ..	Riddell
549	Here's Luck ..	A	Pony ..	Jenz Bros ..	Antwerp
550	Hero	A	Draught ..	J. T. Baker ..	Tyabb
952	,, ...	A	Pony ..	T. Park ..	Wonthaggi North
772	Hiawatha of New Zealand	A	Draught ..	Waldron Bros. ..	Chinkapook
800	High Honour ..	6	,, ..	C. Feldtman ..	Major Plains
752	,, Tide ..	5	,, ..	J. T. Bartlett ..	Brown's Plains

STALLION REGISTER, 1921-22—*continued.*

Cert. No.	Name.	Age.	Class.	Owner.	Address.
		Yrs.			
824	His Majesty ..	A	Draught ..	T. J. Burt ..	Clifton Hill
805	Honest Cleve ..	A	Light ..	W. F. Eichler ..	Chillingollah
933	,, Mac ..	A	,, ..	J. H. Hunt ..	Merrigum
934	,, Wilks ..	A	,, ..	H. D. Adams ..	Kotupna
770	Honey King ..	A	,, ..	O. Martin ..	Leongatha
806	Hotspur	A	Pony ..	Z. L. Small ..	French Island
978	Hover-a-Blink ..	3	Draught ..	J. B. Ferguson ..	Waubra
769	Hullabaloo ..	A	Light ..	J. C. Brooks ..	Ultima
558	Huon's Joy ..	3	Pony ..	C. S. Wade ..	Nunga
551	I Am Here ..	A	,, ..	A. T. Ingram ..	Orbost
935	Ian McClelland ..	A	Draught ..	H. Naylor ..	Rosebery
808	Interest	A	Pony ..	A. Kennedy ..	Tatura
774	Jack	A	Light ..	J. Crozier ..	Numurkah
552	,, Huon ..	A	,, ..	F. G. Ronalds ..	Buninyong
773	,, McKinney ..	A	,, ..	D. Moriarty ..	Wee Wee Rup
809	Jet	A	Pony ..	D. H. McConnell	Longford
647	Jimmy Direct ..	3	Light ..	J. Isaac ..	Inglewood
810	Jubit	A	,, ..	P. J. Kelly ..	Hinnomunjie Bridge
977	Julius of Bolobek ..	2	Draught ..	E. Allan ..	Ondit
811	Jumbo	A	Pony ..	C. and W. Kallawk	Pomborneit
553	Junot	A	Thoroughbred	N. McDonald ..	Purnim
807	Karamu Glenmarkie	A	Draught ..	J. J. Owens ..	Gannawarra
783	Kelly	4	Pony ..	G. F. Schache ..	Jung North
910	Kelm's Best ..	A	Draught ..	R. Fraser ..	Thorpdale
937	Kelso	A	,, ..	T. R. Carty ..	Nandaly
648	Kewell's Pride ..	4	,, ..	A. C. Petrass ..	Kewell
554	Khamseen ..	4	Light ..	S. Winter-Cooke	Hamilton
555	Kilburnie	A	Draught ..	A. E. Whitfield ..	Terrick South
936	Kilmore	A	,, ..	J. J. Ivell ..	Orbost
556	King Almont ..	A	Pony ..	J. Clarke ..	Durham Lead
763	,, Bee	A	,, ..	W. T. McAlpine	Hopetoun
559	,, Jimmy II. ..	A	,, ..	R. H. Larcombe	Mt. Moriac
976	,, of the Roses II.	5	Draught ..	D. Kennedy ..	Longwarry South
814	,, of The Shepherds	A	,, ..	S. R. Campbell ..	Nypo
704	,, Osterley ..	A	Light ..	J. M. Fahey ..	Gnotuk
560	,, Owyhee II. ..	A	,, ..	W. Barkmeyer ..	Koondrook
815	,, Stanley (late Boxer)	A	Draught ..	R. J. Green ..	Winton
812	Kingston	A	,, ..	Hawkins and Henebery	Myrtle Bank
938	King Tony ..	A	Pony ..	J. H. Hunt ..	Merrigum
813	Kinlock	A	,, ..	W. Hicks ..	Miram
816	Knight of The Garter	A	Draught ..	P. McDonald ..	Nagambie
561	,, Royal ..	A	,, ..	C. Hebard ..	Cavendish
614	Kooloo Mount ..	4	Light ..	J. Comb ..	Kooloonong
975	Kumalong ..	5	,, ..	J. A. Kirkpatrick	Lismore
817	Laird of Selkirk ..	A	Draught ..	W. Troy ..	Myall
562	Lanark's Pride ..	A	,, ..	W. Etherton ..	Broughton
656	Lancashire Lad ..	4	,, ..	R. Bunworth ..	Woomelang
563	Larrakin	A	Light ..	H. Sutherland ..	Chinkapook
939	Lee Creek Favourite	A	Draught ..	Ewart Bros. ..	Dargalong
564	Lilburne Regent ..	A	,, ..	J. Hargreaves ..	Dederang
565	Little Argyle ..	A	Pony ..	W. H. Lyon ..	Sale
818	,, Bill ..	6	Light ..	A. T. Corner ..	Fosterville
658	,, Black Pony ..	A	Pony ..	W. Armstrong ..	Branxholme

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Cert. No.	Name.	Age.	Class.	Owner.	Address.
		Yrs.			
600	Little Comet ..	5	Pony ..	T. McNally ..	Seymour
819	,, Milton ..	6	Draught ..	J. Hives ..	Tempy
567	,, Tich ..	A	Pony ..	J. W. Bartlett ..	Stratford
820	Llang Graeme ..	6	Light ..	O'Brien and Johnston	Cowwarr
821	Lord Clarrie ..	A	Pony ..	C. C. Dawkins ..	Colac
961	,, Dalmuir ..	5	Draught ..	G. Harders ..	Dimboola
823	,, Dunbar ..	A	,, ..	M. Giles ..	Hopetoun
540	,, Dundee ..	A	,, ..	C. Lippiatt ..	Scotsburn
775	,, Glengyle ..	A	,, ..	J. Linehan ..	Wunghnu
568	,, Lynden ..	A	,, ..	J. Vickers ..	Colbinabbin West
569	,, Nailstone ..	3	,, ..	J. Murphy ..	Murrayville
825	,, Nolan ..	A	Thoroughbred	J. Sharp ..	Minyip
826	,, Northcote ..	A	Draught ..	W. Hicks ..	Miram
570	,, Plunton ..	A	,, ..	M. and J. Runciman	Mallan
571	,, Shepherd ..	A	,, ..	W. J. Jenkins ..	Burrereo
572	,, Trentham ..	A	,, ..	C. Maher ..	Tatura
573	,, Valcourt ..	A	,, ..	J. H. Roulston ..	Gritjurk
974	,, Wallace ..	2	,, ..	Finlayson Bros.	Wallace
827	Lost Time ..	A	Thoroughbred	A. Martin ..	Maffra
940	Lou Lou's Dandy ..	A	Pony ..	L. W. Clarke ..	Dooen
828	Lymm Champion II.	A	Draught ..	E. Wilson ..	Leongatha
703	,, Forest Boy	A	,, ..	M. Attwood ..	Rosebery
973	,, Truffle II. ..	4	,, ..	W. A. Tyrrell ..	Yarragon
702	Lyndhurst ..	4	,, ..	D. J. McKenzie	Warracknabeal
649	,, II. ..	2	,, ..	A. Arnold ..	Werrigar East
831	Macauley	A	,, ..	H. Fox ..	Yarck
692	Magician	A	,, ..	T. Adkins ..	Korumburra
620	Major Again ..	4	,, ..	H. M. Bywater ..	Nhill
574	Maldon	A	Pony ..	J. E. Sage ..	Somerville
601	Maltdale	5	Light ..	H. Williamson ..	Whorouly
575	Maltese Cross ..	A	,, ..	T. J. Witherow	South Wangaratta
918	Maringa	A	,, ..	E. Collins ..	Dunkeld
829	Masher Boy ..	A	Pony ..	T. Mellington, jun.	Yaapeet
906	Mauri Gip.. ..	4	Light ..	A. R. B. Guest ..	St. Kilda East
830	McGregor's Fancy ..	A	Draught ..	R. J. Wilson ..	Krowera
657	Melrose Bounty ..	A	Light ..	Woodmason's Melrose Dairy Pty. Ltd.	Malvern
832	Merrimu	A	,, ..	G. M. Vallence ..	Cohuna
931	Merry Peals ..	A	,, ..	D. McLeod ..	Kyabram
903	Merzug	5	,, ..	H. Doherty ..	Hill End
941	Mickey	A	Pony ..	R. Booley ..	Banyan
833	Middlemarch ..	A	Draught ..	M. J. Egan ..	Charlton
834	Miniature III. ..	A	Pony ..	T. Robertson ..	Macarthur
576	Minstrel	A	,, ..	D. Begley ..	Colac
971	Mooser	4	Draught ..	K. MacInnes ..	Lake Bolac
835	Morocco Lad ..	6	,, ..	A. Arnold ..	Werrigar East
577	Moving Picture ..	A	Thoroughbred	Executors late T. Maidment	Moyston
887	Mulga	4	Light ..	H. J. Cannard ..	Massey
836	Napar	A	,, ..	E. Tozer ..	Porepunkah
615	Never Forget ..	A	Pony ..	F. Ballard ..	Picola
888	Newfield's Pride ..	3	Draught ..	J. M. Martin ..	Aubrey

STALLION REGISTER, 1921–22—*continued.*

Cert. No.	Name.	Age.	Class.	Owner.	Address.
		Yrs.			
837	Newton's Best ..	A	Draught ..	E. G. Bath ..	Swanwater West
616	Newton Style ..	5	,, ..	W. G. Wilkinson	Boomah
617	Niggering	2	Light ..	E. G. Træger ..	Merbein South
838	Norval Junior ..	A	,, ..	J. English ..	Cavendish
578	Oakburn	A	Draught ..	C. A. Roberts ..	Glenalbyn
942	Oakwood	A	Light ..	G. Inglis ..	Tallygaroopna
970	,, Direct ..	5	,, ..	A. E. Kay ..	Dean
579	Onward	A	Draught ..	H. T. Wilson ..	Wodonga
625	Operation ..	A	Light ..	T. Ley, jun. ..	Tallangatta
943	Orbost Again ..	A	Draught ..	G. T. Deckert ..	Kinimakatka
944	Orient	A	Light ..	J. Wilson ..	Stacey's Bridge
602	Orion	A	Thoroughbred	W. D. Cross ..	Tangambalanga
839	Our Guide ..	A	Light ..	M. P. Ryan ..	Yundool
945	Owyhee Chief ..	A	,, ..	J. Shanahan ..	Richmond
840	Oyama	A	,, ..	J. H. Rodgers ..	Dean
841	Panic	6	,, ..	R. J. Hawkins ..	Dalyston
842	Patrician	A	Draught ..	A. R. McKenzie	Wallup
911	,, Pride ..	4	,, ..	I. E. Barrett ..	Traynor's Lagoon
787	Patrick's Pride ..	A	,, ..	E. L. Edwards ..	Bacchus Marsh
843	Patriot	A	,, ..	A. G. Mibus ..	Croxton East
654	Patrobas	A	Thoroughbred	Mrs. E. A. Widdis	Rosedale
844	Petrillott	A	,,	W. D. King ..	Tatyoon
845	Phylactery ..	A	,,	A. B. Gibbins ..	Gladfield
580	Piper	A	Pony ..	J. Ford ..	Wickliffe
917	Premier Darnley ..	A	Draught ..	Sham Singh ..	Manangatang
627	Premier's Fancy ..	A	,, ..	R. Jack ..	Rutherglen
846	Premier Ward ..	A	,, ..	J. A. Warburton	Lalbert
847	Preston Junior ..	A	Light ..	J. McLure and Son	Drummond
581	Pretty Bobby ..	A	Pony ..	W. and W. G. Hall	Talbot
583	Pride of Clutha ..	6	Draught ..	J. H. Cornfoot ..	Whittlesea
582	,, The South	A	,, ..	Mrs. S. E. Kent	Sheep Hills
584	Prince Benmore ..	A	,, ..	W. D. Starbuck	Rupanyup
848	,, Coupar ..	A	,, ..	J. Archibald ..	Jan Juc
849	,, Douglas ..	A	Light ..	P. Martin ..	Molesworth
850	,, Edward ..	A	Draught ..	D. King and Sons	Rutherglen
889	,, Ettrick ..	A	,, ..	A. R. Paynter ..	Violet Town
609	,, Hafrod ..	3	Pony ..	Miss B. Bruce-Reid	Bundoora
585	,, Harold ..	A	Light ..	C. E. Darley ..	Hopetoun
622	,, ,, ..	A	Pony ..	H. Robertson ..	Wallacedale
586	,, Lyall ..	5	,, ..	G. L. Buchanan	Horsham
650	,, Myalls ..	4	Light ..	W. T. McAlpine, jun.	Hopetoun
851	,, of Lorne ..	A	Draught ..	E. H. P. Young	Congupna-road
587	,, of Nullan ..	A	,, ..	R. I. Quick ..	Brim
588	,, Que ..	A	Pony ..	A. E. Callow ..	Ballarat
589	Prince's Ribbon ..	A	Light ..	W. A. Riedell ..	Tongala
626	Punch	A	Draught ..	E. H. B. Cleeland	Cowes
905	Punter	A	Pony ..	R. Ready ..	Rutherglen
618	Quatta's Baron Belmontian	4	Draught ..	R. F. Carmody ..	Everton
948	Rael Locin ..	A	Thoroughbred	J. Nicol ..	Agnes
590	R.H.Y. Harold ..	5	Pony ..	V. E. Ladlow ..	Dooen North
852	Ribbon Wheel ..	A	Light ..	V. Vaughan ..	Condah
591	Robert Alto ..	A	,, ..	A. Kennedy ..	Arcadia
776	Rocket	6	Pony ..	R. M. Whelan ..	Apollo Bay

STALLION REGISTER, 1921-22—*continued.*

Cert. No.	Name.	Age.	Class.	Owner.	Address.
		Yrs.			
593	Royal Bob ..	A	Draught ..	J. Parle ..	Carwarp
946	,, Charlie ..	A	,, ..	W. Sanders ..	Nalinga
853	,, Churchill ..	A	,, ..	H. A. Wright ..	Pine Lodge South
655	,, Dandy ..	A	Pony ..	D. Fletcher ..	Gannawarra
594	,, Duke ..	5	Draught ..	C. W. Dennert ..	Hamilton
524	,, Escort ..	A	,, ..	T. Casson ..	Pinnaroo, S.A.
947	,, Gartley ..	A	,, ..	D. Butler ..	Mellis
595	,, Garvin ..	A	,, ..	G. F. Brown ..	Winchelsea
854	,, Hero ..	A	,, ..	G. Giddings ..	Sea Lake
893	,, Lad ..	A	,, ..	T. J. Dean ..	Landsborough
637	,, Prince ..	A	,, ..	C. E. Umbers ..	Sea Lake
908	,, ,, ..	3	,, ..	J. J. Gleeson ..	Southern Cross
855	,, Reserve ..	6	Light ..	W. M. Vale ..	Yarram
596	,, Ribbon ..	A	Draught ..	J. Morris ..	Piangil
624	,, Rufus ..	4	Light ..	A. E. Hardy ..	Yarraville
611	,, Seal ..	2	Draught ..	T. Thornton ..	Waaia
954	,, Sovereign ..	3	,, ..	A. Colvin ..	Nathalia
666	,, Standard ..	A	,, ..	D. Foubister ..	Minyip
667	,, Success ..	A	,, ..	F. W. Kossatz ..	Woorak
949	,, Treasure ..	A	,, ..	W. H. Thompson	Yalca
777	,, Whips ..	A	Light ..	A. J. Walter ..	Warragamba
771	Ruby's Pride ..	A	Draught ..	E. Narik and F. Thornton	Edenhope
668	R. W. Estell ..	A	Light ..	A. E. Lobb ..	Lamplough
904	Safe Voyage ..	3	,, ..	D. Murchison ..	Numurkah
756	Sam Huon ..	5	,, ..	J. P. O'Brien ..	East Melbourne
856	Sarsfield	A	Pony ..	D. J. Kelleher ..	Kilmore
886	Saturn	A	,, ..	A. J. Plum ..	Docker's Plains
902	Scotch Spirit ..	A	Thoroughbred	J. F. Ryan ..	Elsternwick
765	Scotland's Bloom ..	A	Draught ..	J. K. Shepherd ..	Galah
858	Scotland Yet ..	A	,, ..	A. E. Capron ..	Lethbridge
950	Scottish Lad ..	A	,, ..	D. L. Bodey ..	Jung
857	Scotty	6	,, ..	P. Bagnell ..	Mologa
669	Scotty Chief ..	A	,, ..	A. Rintoule ..	Kinimakatka
802	Seabound	A	Thoroughbred	E. N. Wood ..	Caulfield
778	Seacombe ..	A	Pony ..	A. A. Barton ..	Camberwell North
969	Sea King	A	Draught ..	A. McCready ..	Colac
670	Shanter's Ghost ..	A	Pony ..	L. Dickerson ..	Natimuk
968	,, Pride ..	4	Draught ..	G. A. Thomson	Kyneton
628	Shepherd	A	,, ..	A. J. North ..	Ararat
701	Shepherd's Boy ..	5	,, ..	Biggs Bros. ..	Carrum
671	,, Pride ..	2	,, ..	T. Winderlich ..	Horsham
967	Shilinga	5	Light ..	D. McLennan ..	Derrinallum
672	Siam	A	,, ..	J. W. Smith ..	Elmore
653	Sir Amyas.. ..	A	Thoroughbred	Mrs. E. A. Widdis	Rosedale
859	,, Angle	A	Light ..	A. A. Lee ..	Tallangatta
673	,, Carlaw.. ..	A	,, ..	T. J. Byrne ..	Arcegra
651	,, Dale	3	Draught ..	W. Turnbull ..	Wedderburn
860	,, Hector.. ..	A	,, ..	F. T. Wallbridge	Somerton
951	,, Roderick ..	A	,, ..	W. Byrne ..	Trentham
629	,, Several ..	3	Light ..	D. C. Chilcott ..	Dookie
674	,, Thomas ..	A	Draught ..	W. H. Lyon ..	Sale
675	,, William ..	A	,, ..	W. A. McClellan..	Bungaree
630	Smart Style ..	5	Light ..	R. M. Davis ..	Boort
676	Snapshot	5	,, ..	H. Crawford ..	Victoria Valley

STALLION REGISTER, 1921–22—*continued.*

Cert. No.	Name.	Age.	Class.	Owner.	Address.
		Yrs.			
677	Southerton ..	A	Light ..	F. Mason ..	Minyip
953	Splendour ..	A	,, ..	J. McKenna ..	Picola
592	Sportsman's Hero ..	6	Draught ..	A. Kennedy ..	Tatura
861	Standard	A	,, ..	A. Rees ..	Casterton
784	Stanley May ..	5	,, ..	G. R. Ladson ..	Mincha West
862	Starlight	A	,, ..	J. Fuller ..	Mitre
863	,, ...	A	Pony ..	J. Giles ..	Bairnsdale
864	Stirling Prince ..	A	Draught ..	R. A. Cumming	Kerang
678	Stockman's Lad ..	6	,, ..	W. H. Mitchell ..	Ouyen
661	Straightaway ..	A	Light ..	T. Allen ..	Glenloth East
890	St. Mark	A	Draught ..	F. Marshman ..	Brim
679	,, Simon	A	,, ..	G. J. Butler ..	Carisbrook
631	Sudbourn's Victory	5	,, ..	A. C. Head ..	Seymour
865	Sunbeam	A	Pony ..	D. Ahern ..	Wahring
662	Sunbury	A	Light ..	T. C. Nolan ..	Tarrawingee
966	Sunshine	4	Pony ..	S. H. Wilson ..	Katamatite
866	Sydney Derby ..	A	Light ..	Mrs. M. Johnson	Northcote
680	Taffy	A	Pony ..	C. H. Waters ..	Corryong
786	Tennyson	3	Light ..	A. J. Yeaman ..	Tennyson
867	The Barb	A	Pony ..	R. C. Boddy ..	Woodside
781	,, Butler ..	A	Light ..	Helwig Bros. ..	Glenlee
891	,, Crown ..	A	Draught ..	S. Atwell ..	Rainbow
868	,, General ..	A	,, ..	J. A. Lord ..	Boigbeat
869	,, Leeward ..	A	Light ..	H. T. Gilbert ..	Fawcett
871	,, Macdonald ..	A	Draught ..	A. Wohlers ..	Mount Wallace
870	,, Masher ..	A	Light ..	W. Williams ..	Corrin's L.B.
872	,, Premier ..	A	Draught ..	R. and H. Carter	Marong
603	,, Prince ..	4	,, ..	J. G. Wilson ..	Milawa
621	,, Scrip	A	Thoroughbred	J. C. Ware ..	Tatyoon North
873	,, Standard ..	A	Draught ..	J. Forsyth ..	Murrayville
660	,, Verger ..	A	Light ..	A. F. Cullen ..	Wahgunyah
964	,, Voyager ..	3	,, ..	J. E. Downey ..	Wallace
874	Thoughtful ..	A	Pony ..	P. McIntosh ..	Ondit
875	Titiroa Baron ..	A	Draught ..	Hercus Bros. ..	Hayanmi
876	Togo's Chief ..	A	,, ..	J. W. Gardner ..	Cavendish
892	Tom Almost ..	A	Light ..	W. Merrigar ..	Goorambat
907	Tommy Alto ..	3	,, ..	P. M. Morris ..	Toorak
782	,, Huon ..	A	,, ..	J. Watkins ..	Euroa
877	Tom Tit	A	Pony ..	R. W. Jukes ..	Maryborough
664	Top Gallant ..	A	Draught ..	E. Ervin ..	Pimpinio
878	Tracey Alto ..	A	Light ..	W. Calaby ..	Ararat
955	Trelawney Time ..	6	Draught ..	R. H. Larcombe	Mt. Moriac
901	Uxbridge Fyvie ..	A	,, ..	W. Charles ..	Maldon
879	Varcoe	A	Thoroughbred	W. M. Meekin ..	Kerang
681	Ven Error	A	Light ..	J. C. Wallis ..	Miram
682	Viking	A	,, ..	A. G. Turnbull ..	Horsham
880	Von Atom II. ..	A	Pony ..	J. H. Padgett ..	Berrybank
956	Waironga Prince ..	A	Draught ..	G. W. Fielding ..	Watchem
683	Wally	A	,, ..	N. C. Keating ..	Speed
963	Wee Jim	5	Pony ..	E. Pickering ..	Portarlington
962	Welcome Bells ..	5	Light ..	T. J. Splatt ..	Weering
881	,, Lock ..	A	,, ..	J. L. Meagher ..	Moyhu
684	Welsh Flyer ..	A	,, ..	P. J. Reid ..	Milawa
882	Wenba	A	Pony ..	J. O'Keefe ..	Winslow
685	Westmont	A	Light ..	W. Hay ..	Bullock Swamp
696	White Stockings ..	A	,, ..	Munro Bros. ..	Walpeup
751	Whyami	A	,, ..	A. G. Gook ..	Inglewood

STALLION REGISTER, 1921–22—*continued.*

Cert. No.	Name.	Age.	Class.	Owner.	Address.
		Yrs.			
632	Widgiewa Heir ..	3	Draught ..	D. Tweddle ..	Yarroweyah
801	,, Cavalier ..	A	,, ..	W. G. Wilkinson	Boomah
957	Wiewood	A	Light ..	W. Rafferty ..	Shepparton
912	Wigton's Pride ..	2	Draught ..	J. Browne ..	Werribee
686	William of Orange ..	A	Thoroughbred	S. Bullock ..	Essendon
633	Willie Craig ..	3	Draught ..	G. Oxley, jun. ..	Gre Gre North
687	Yet Again ..	A	Pony ..	J. H. Hindhaugh	Weerite
688	Yorkie II... ..	A	Light ..	G. J. McVean ..	Thougla
689	Young Brigham ..	A	Pony ..	J. A. Darlington	Paradise
883	,, Clarionet ..	A	Light ..	J. Mitchell ..	Piavella
690	,, Clyde ..	A	Draught ..	Currell Bros. ..	Cowley's Creek
691	,, Comet ..	A	Pony ..	T. Adkins ..	Korumburra
959	,, Coronation	A	Draught ..	G. Pitt ..	Jeparit
960	,, General ..	A	Pony ..	W. Madill ..	Tongala
884	,, Ki Ki ..	A	,, ..	T. Robertson ..	Macarthur
693	,, Laddie ..	A	,, ..	F. R. Butler ..	Newstead
541	,, Linkwood ..	A	Draught ..	J. H. Peverill ..	Charlton
663	,, Lord Ronald	A	,, ..	W. Phillips ..	Gorae West
694	,, Lyon ..	A	,, ..	A. W. Brown ..	Speed
695	,, Nailstone ..	A	,, ..	Schroeder Bros...	Murrayville
822	,, Shepherd ..	4	,, ..	G. Chapman ..	Minyip
885	,, Shifter ..	A	Light ..	A. Linke ..	Jeparit
665	,, Timekeeper..	A	Draught ..	N. Crowley	Dalmore

ORCHARD AND GARDEN NOTES.

The Orchard.

E. E. Pescott, F.L.S., Pomologist.

SPRAYING.

The spray pump should now be in thorough working order, so that the various spring sprayings may be carried out with as little interruption as possible. It is always wise to clean out the pump after each spraying, so that it will be ready for the next mixture. Putting a different spray in a pump barrel that has not been washed out, very often causes the formation of a sediment, which blocks the nozzle and interrupts the work.

During November it will be necessary to spray for codlin moth, peach aphis, pear slug, and various leaf-eating insects. In addition, black spot of the apple and pear, shot hole, and other fungus diseases must be kept in check. As various sprays are required for all of these troubles, the necessity of always having a clean pump is evident.

At the present time the best spray for peach aphis is strong tobacco solution, and the same spray may also be used for the pear slug. Arsenate of lead is the better spray for this latter insect, but it should not be used when the fruit is approaching the ripening stage; hellebore may also be used for the slug with good effect.

As a preventive against codlin moth, the trees should be kept well sprayed with arsenate of lead. The first spraying should

have been given at the time of the falling of the petals; the second spraying, owing to the rapid expansion of the fruit, should be given a fortnight later. After that the grower must use his own judgment as to the necessity for subsequent sprayings. If the moths be at all prevalent, other sprayings will be quickly necessary.

As the woolly aphis is increasing at this time of the year, it will mean a saving of a large number of buds if this insect be sprayed. Nicotine solution, pine spray, or lime sulphur may be used with good effect.

Cultivation.

The work of ploughing and harrowing should be completed immediately. All crops for green manure should be now under cover, and if the orchard soil is at all heavy or stiff, the grower should make up his mind to grow a crop next season, in order that this condition may be reduced.

The orchard should be kept free from weeds, not only for the conservation of moisture, but in order to do away with all hiding places of the Rutherglen fly, cutworm moths, &c.

General Work.

Grafted and newly-planted trees should be frequently examined, and given an occasional watering and overhead spraying, in order to encourage their growth, and to prevent loss of moisture from the foliage. It is also advisable to mulch young trees with light grass, or straw mulching not too rich in animal manure.

The disbudding of unnecessary shoots and the pinching back or stopping of growths, to prevent their becoming unduly long, may now be carried out. This work is particularly important on young trees.

Graft ties should be examined, and the ties cut wherever any growth is being made. Where the grafts are likely to make any long growth, they should be well staked and tied.

Citrus trees may be planted out, and, after planting, they should be watered and mulched.

The Vegetable Garden.

Tomato plants should now receive attention every day; laterals will require pinching back; crowded bunches and shoots should be thinned; the plants should be well tied to the stakes, and liberal supplies of water and manure should be given. One or two more plantings of tomato plants may still be made, so that there may be strong, sturdy plants for the production of late fruits. By planting three or four successions of plants, it is possible to have a good supply of fruits from December to June. Pull up and burn all plants showing any signs of disease.

Celery may now be sown for winter crops. French beans should be largely sown. Cucumber, melon, pumpkin, and all seeds of this family may now be sown in the open.

Where these plants are already growing, the longest and strongest runners may be pinched back, to throw the strength into flowering and lateral growths. Watch the plants for mildew, and use sulphur freely wherever present, especially on the young plants.

Peas, lettuce, radish, turnip, cabbage, and sweet corn seeds may be sown this month. Seedlings from former sowings may be planted out, and it would be well to dip the whole plant in water before planting.

This greatly assists the young plants while taking hold of the soil in their new location.

Frequent waterings and frequent cultivation will now be necessary; and all weeds must be hoed or hand-weeded out; mulching with stable manure will greatly assist the plants.

A few beds should now be deeply worked, adding a liberal dressing of stable manure. These plots will then be ready for the celery, cabbage, and other seeds planted during this month.

The Flower Garden.

Continue to plant out the various bedding and foliage plants, corms of gladioli, and seed of such tender annuals as Phlox Drummondi, balsam, zinnia, nasturtium, celosia, aster, cosmos and portulaca.

While seeds planted out in the open germinate and grow fairly well, it is advisable during the summer months to plant these in sheltered seed beds, or in a canvas or calico frame. The protection need be on the one side only, preferably the west or north-west; the seedlings are then protected during the hottest part of the day. At the same time the shading should not be sufficient to unduly "draw" them.

The seeds should not be deeply sown, and all waterings should be light. A little water, often, should be the rule for seedlings. Annuals require plenty of room when planted out in the garden. Being quick growers, they are generally gross feeders, and they must have space to develop a good root system. Feeding, too, with liquid manure is helpful when they are reaching the flowering stage.

Dahlias may now be planted out, either from tubers or from young rooted cuttings. These will give good early summer blooms. For autumn and show blooms, the planting should be deferred until the middle of December.

Herbaceous and succulent plants should be staked for protection; included in this section are delphinium, gladiolus, perennial phlox, rudbeckia, &c. These plants will all benefit from liberal mulchings and watering with liquid manure when approaching the blooming period. Spring flowering bulbs, corms, and tubers should now be lifted and stored.

The soil surfaces will now benefit from frequent hoeings and stirrings. Constant waterings will be required if the weather be hot or windy. the cultivation should quickly follow the waterings in order that the moisture may be thoroughly conserved. Mulching with stable manure is also beneficial at this season.

REMINDERS FOR DECEMBER.

LIVE STOCK.

Sheep.—Dispose of all faulty-mouthed ewes, inferior-fleeced wethers, and coarse-flock sorts in best condition at any time possible. Those in favoured areas can replace with younger, better, finer-grade sorts. Where ewe lambs are intended to be held for future breeding, see that the cross results in shafty, fine to medium grade fleeces, as well as a shapely frame. Allow rams to remain with the ewes seven weeks, this period admitting of any ewes coming in season the second time. It is rarely necessary to join more than 3 per cent. of 2 tooths, 3 per cent. of 5 and 6-year olds, or 2 per cent. of 2, 3 and 4 year old rams, unless with young ewes.

Where conditions justify it, 4 per cent. of vigorous matured rams with aged coarse crossbred ewes will bring a greatly increased number of twin lambs. Clear wool from eyes, and burrs from about the pizzles of rams, and cut hoofs into shape before mating. Ewes should be of one breed, or as near one cross as possible, to insure an even and rapid dropping. Merino and fine cross ewes are in season earliest, first cross or half-breds later, and all ewes with a preponderance of British blood later still. It is useless to join rams with ewes until their proper time of coming in season. Ewes carry their lambs four months, four weeks, four days, or roughly, five months.

Poultry.—Add a little pearmeal to morning mash and give less bran. Feed equal parts wheat and heavy oats at night. Supply plenty of green food—at this time, lettuce is invaluable. Avoid salt meat of any description. Put Douglas mixture in drinking water when required. Keep ample supplies of sand, ashes, &c., in pens, and moisten same. This will enable the birds to keep themselves cool and clean. Top off geese, ducks, and cockerels for the Christmas markets. Hens will do better this month by having free range. Remove all male birds from flocks, as infertile eggs will keep longer and command a higher price.

Vineyard.—Inspect young grafted vines (field or bench); suckering and removal of scion roots should be carefully attended to—See *Bulletin No.* 38 (Spring Grafting), obtainable on application. Tie up young vines. Beware of cut worms on young vines (information concerning this pest posted on application). Tying up of bearing vines, if practised, should be completed early in month. Avoid excessive and indiscriminate topping, far too frequent in Victoria. Scarify, if soil is not sufficiently loose, and after heavy rain or irrigation. Look out for oidium and repeat sulphurings on first appearance of disease. Further spraying for Downy Mildew will be needed if weather conditions favour the fungus.

Cellar.—Fill up regularly and keep cellars as cool as possible

BEE-KEEPING.

December is the month for the main honey flow from yellow box and red gum. Swarming is practically over for the season except, perhaps, in late districts. Where there has been more swarming than the owner of the bees desired, and the total yield of honey is the object aimed at rather than increase in the number of colonies, the weaker stocks may be united at the commencement of the honey flow, as the highest return is secured by having a given number of bees in the fewest possible number of hives; that is to say, 50,000 worker bees in one hive will store a far greater amount of honey than the same number in two hives with 25,000 bees in each. Such a large worker-force requires three bodies of full-depth frames, otherwise the best results cannot be obtained, because nectar being as thin as water when brought in by the bees, only a little is put into each cell to hasten evaporation. When, therefore, sufficient empty combs are not available to the bees, part of the worker-force will be idle.

Each colony should have at least three sets of Langstroth size combs, and when these are not available the time of the red gum honey flow is suitable for getting new combs drawn out from full sheets of foundation. Comb foundation is expensive, but in the end combs built from starters are more expensive still, because so much drone comb is built when starters only are given, that one of the principal advantages of the frame-hive system is lost.

All frames should be wired, four horizontal wires being most in favour with beekeepers; the wires should be well embedded into the foundation so that it may not come away from them. Between the bottom edge of the sheet of foundation and the bottom bar of the frame there should be a space of at least ¼-inch, to allow for the expansion of the sheet by the heat of the hive.

The best combs are obtained when the foundation is drawn out by the bees in the super immediately over the brood nest without an intervening excluder.

Combs should be capped at least two-thirds before being extracted, so that the honey will be of good density. When hives are run three stories high, as indicated above, there is no necessity to extract all the honey at one time; one set of combs can be extracted, and the empty combs returned to the hive, and when they are partly filled again the others can be taken. In this way the bees are not upset so much as when all the combs are wet and sticky after extracting, and the risk of leaving the hive destitute of stores is avoided should the honey flow suddenly cease.

PASPALUM DILATATUM

or Golden Crown

Paspalum Dilatatum

A valuable Forage Grass for all kinds of stock. Withstands drought, and frosts will not kill it. Particularly suitable for dairy cattle. Stands any amount of grazing, and trampling of stock does not injure it. A fire has been run over it, and after this severe treatment, it grew as vigorously as ever.

Paspalum does well in the ashes of burnt timber, especially when the rainy season sets in.

Useful for sowing when desirable to clear land of undesirable plants. Sow only the best, heavy, hand shaken seed. Gives the best germination by far.

We wish to caution buyers against the cheap grades offered at ridiculously low prices.

Hand shaken seed, 1/9 per lb.; 186/- per cwt. in ½-cwt. lots or more.

TWO VALUABLE MILLETS

PENCELLARIA *(African Millet)*

A very valuable fodder plant, coming in early, growing to a height of 6 to 8 feet, much relished by all kinds of stock. Three or four cuttings may be made in the season in warm districts. Sow 6 to 8 lbs. to the acre. Makes excellent hay. 1/3 per lb.; 112/- per cwt.

EGYPTIAN or PEARL MILLET

This is one of the most wonderful forage plants that have ever been introduced. Stock eat it with great avidity. It can be cut three or four times, sprouting readily and growing rapidly after each cutting. Sow in drills 3 feet apart, dropping seed 2 feet apart in drills as plenty of room is required for its growth. Four pounds of seed are sufficient for an acre. 1/3 per lb.; 112/- per cwt.

LAW, SOMNER Pty. Ltd.

Established over 71 Years

Seed Merchants and Nurserymen

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Booklet giving useful information on Sudan Grass Post Free on application

DEPARTMENT OF AGRICULTURE, VICTORIA

Red Poll Dairy Herd

The Department will shortly have completed the orders for the 56 bull calves that were booked ahead of calving when the advertisement was withdrawn; consequently the booking of orders for bull calves from the forthcoming spring calvings has now been resumed.

BULL CALVES are sold for delivery at a month old at prices based approximately on the actual milk and butter fat record of the dam at the rate of 1s. per lb. of butter ***fat*** yielded.

(See Record of Yields published annually in this Journal.)

The Bulls in Use include—

LONGFORD MAJOR (Imported)

Dam's Record 14713 lbs. milk ... 6 years average 11338 lbs. milk
G. Dam's ,, 10548 ,, ... 4 ,, ,, 9155 ,,

BELLIGERENT (Imported)

Dam's Record (1st milking) 7144 lbs. milk.

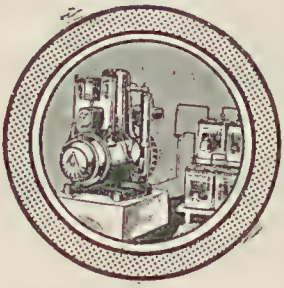
Dam's Dam's	,,	14533 lbs. milk	...	4 years	average	12871 lbs. milk
Sire's Dam's	,,	10370 ,,	...	7 ,,	,,	9354 ,,
Sire's D. Dam's	,,	9510 ,,	...	12 ,,	,,	8033 ,,
G. Sire's D. Dam's	,,	10215 ,,	...	7 ,,	,,	9386 ,,
G.G. Sire's D. Dam's	,,	12565 ,,	...	10 ,,	,,	8853 ,,
G.G.G. Sire's D. Dam's	,,	10088 ,,	...	2 ,,	,,	9754 ,,

Inspection of the Herd is Invited.

Visitors will be met at the Station on notifying the Manager, State Research Farm, Werribee.

Application for purchase to

Dr. S. S. CAMERON, DIRECTOR OF AGRICULTURE, MELBOURNE.



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Delco-Light will drive the Sharples Moto-Milker

This wonderful portable two-cow milker is easily the best on the market. One man can milk a herd of 20 in 45 minutes. It is absolutely portable, and it is the one milker that has the compressed air squeeze; this gives rapid and easy milking, and the cows like it and give more milk.

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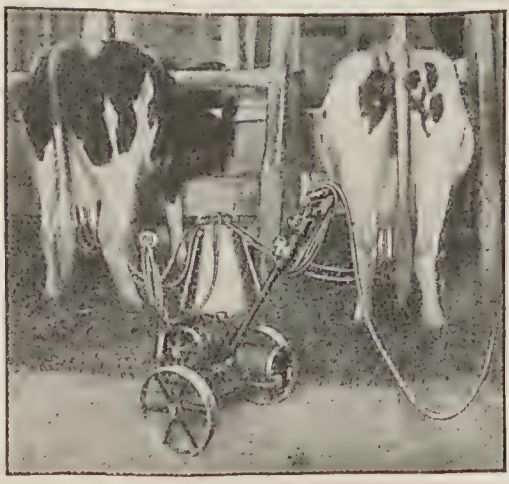

Illustration of the Sharples Moto-Milker in action.

☞ Note the portability and ease of operation

DEPARTMENT OF AGRICULTURE, VICTORIA

Pure Ayrshire Bulls

for Sale

STATE FARM, RUTHERGLEN

Royal Prince of Gowrie Park

Colour, Brown and White. *Calved 30th July, 1915*

Bred by Mr. W. P. Brisbane, Gowrie Park, Weerite, Victoria.

Pedigree.

Sire: Wallace of Gowrie Park (675) A.H.B. of A.
Dam: Princess of Gowrie Park (1710) by Heather of Jock 2nd (387)
2nd Dam: Princess 4th of Luminous of Oakbank (456)
3rd Dam: Young Princess by Dahlia's Adonis (172)
4th Dam: Princess by Young Norman (225)
5th Dam: Fancy by Earl of Seafield (422)
6th Dam: Princess by Norval.

Princess of Gowrie Park yielded 8,930¼ lbs. milk with a 4·67 test in 273 days.

COLLEGE PRINCE

Colour, Brown and White. *Calved 24th September, 1917*

Bred by Department of Agriculture at the State Farm, Rutherglen.

Sire: Royal Prince of Gowrie Park by Wallace of Gowrie Park (675) A.H.B. of A.
Dam: Irene 2nd of Flinders by Glen Elgin's Combine.
2nd Dam: Irene of Flinders by Gleneira's Monsieur (546)
3rd Dam: Irene of Gleneira (1727) by Majestic of Oakbank (326)
4th Dam: Isabel of Gleneira (1036) by Red Chief (359)
5th Dam: Gaiety (1006) by Dainty Davie.
6th Dam: Princess (270) by Prince.

Irene 2nd of Flinders yielded 570 gallons of milk with a 4·2 test in 304 days.

Inspection of these Bulls at the State Farm, Rutherglen, is invited

Application for purchase to

Dr. S. S. CAMERON, Director of Agriculture, Melbourne

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In Powder Form—Mixes Readily in Cold Water.

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And at SYDNEY & BRISBANE. *CORRESPONDENCE INVITED.*

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The "Banyule" Jersey Stud

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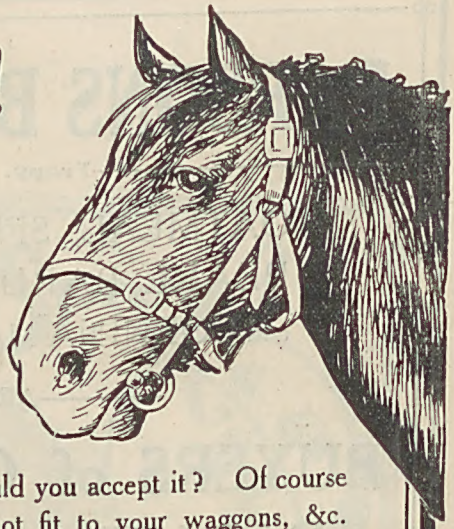
Farmers!

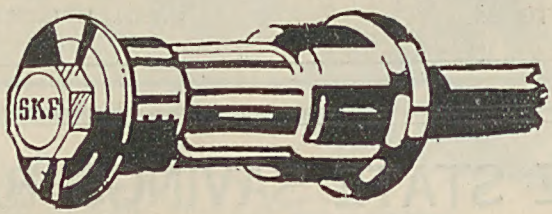
FREE:

A Horse



If you were offered a horse free with up-keep provided for every two you own, would you accept it? Of course you would. Then why not fit to your waggons, &c.

SKF BALL BEARING HUBS & AXLES



The extra service they GIVE is equal to an additional horse without cost. They reduce friction to such a negligible quantity that a mere push of the hand will start a heavily-loaded waggon moving. This minimising of friction means that a 30 to 50 per cent. increased load can be pulled without extra work on the horses; or that two horses can do the work of three or four, so enabling you to cut down your stable and yet maintain your usual transportation

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